ELECTRICAL WORLD

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Associated Gas & Electric Company in Federal Trade Hearing

BUT for a single deviation, and that into the affairs of Utah Power & Light Company, activities of the Federal Trade Commission in its investigation of public utilities have been concentrated for the past two weeks upon the history, policies and practices of the Associated Gas & Electric System.

Early in the presentation of data by the commission's own examiners, Charles Nodder testified that J. I. Mange, president of the company, and H. C. Hopson, its vice-president and treasurer, came into control of the system in 1924 in consideration of a cash payment of $10,000 and the entire outstanding common stock of 1,000 shares of Associated Securities Corporation, which holds the entire outstanding common and controlling stock of Associated Gas & Electric Company.

The original investment in Associated Securities, according to the examiner, was $298,318 and gained for Mr. Mange and Mr. Hopson "complete control" of the Associated System. The return of this investment during the seven-year period from 1923 to 1929, he said, averaged 60.8 per cent.

As far as the Associated System is concerned, he said, the "top" company or so-called "parent" company is Associated Gas & Electric Company. The operating, servicing and various other corporations in the system, the examiner set forth, are held through the medium of a number of subholding companies. These subholding companies, he stated, are for the most part "nothing more than bookkeeping units," having neither employees nor organization, but simply "a set of account books, minute books and supporting papers."

Mr. Nodder testified that "numerous write-ups or appreciations" of stocks have been made by the Associated company and that as far as common stocks are concerned their market value has played "little part" in the method of carrying their values on the books.

"Write-ups" in security investments made by the company, excluding write-ups made by the numerous subholding companies and "trusts," resulted in a net appreciation on the books of the company at the close of 1929 of $33,362,152, the examiner stated.

These "write-ups," he said, have followed three methods: (1) appraisal to "market value"; (2) adjustment of value of investments to agree with "book value" on subsidiary books and (3) corporate surplus of a subsidiary transferred to stated capital for common stock.

Other topics covered in the various sessions were management fees, purchasing service fees, write-ups and write-downs and the policy of restricting to a minimum the issue of underlying bonds and preferred stocks of local operating companies and "building up in every possible way of the credit of the Associated Company." Intercompany profits were also discussed.

Utah Power & Light testimony

The inflation of assets on the books of Utah Power & Light Company, according to the testimony presented in that hearing, arose largely through property acquisitions. In December, 1912, it was said, properties costing Utah Securities Corporation (which controls Utah Power & Light) $6,480,708 were written on the books of Utah Power & Light at $22,100,000, or at an excess of $15,619,000.

This Week

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New England Power Sells 1,003 Ranges in Six Weeks

In the first completely co-ordinated selling activity of the electric companies affiliated with the New England Power Association 1,003 ranges have been sold in a period of six weeks. Despite the difficulties of the times, 350 of these were sold for cash and only 150 on the maximum term of two years. The drive embraced every retail electrical property on the system. Dealers co-operated with the companies on a commission basis and utility employees sold on commission. The quota was 1,000 ranges and vigorous prize competition was staged between companies in the seven major districts forming the association group.

The association standardized for the campaign on a 9,400-watt Graybar-Crawford range offered at $130 installed complete with free wiring without trade-in allowances and on a down payment of $10. A "flying circus" from Boston composed of representatives from headquarters, jobber and manufacturer organizations laid the groundwork for

groups of local properties at major geographic centers. Newspaper advertising, a plan book featuring the drive as a military campaign, weekly bulletins and other sales helps contributed to the success of the undertaking. The estimated increased use of energy per year on the system due to these range sales is 1,504,500 kw.-hr.

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Federal Power Revenue Policies Discussed

With sales of electrical energy mounting to millions of dollars annually from federal reclamation projects, the growing importance of hydro-electric power as a factor in reclamation requires "modification" of original policies, Commissioner Elwood Mead of the Bureau of Reclamation stated last week in an address before the American Society of Agricultural Engineers.

The position of the bureau, Dr. Mead said, in a paper presented for him, has been that the plants are the perpetual property of the federal government. The revenue from the sale of power has been applied to the payment of the projects and supplementary to the payments of irrigators for constructing canals, etc. He continued:

"What will be done with the power revenues after the works are paid for is still an open question, both in the Colorado River development and in the legislation for the Columbia River."

In recent appropriation acts, pointed out Dr. Mead, the terms of the appropriation provide that after the works shall have been paid for, then the net profits are to go into the reclamation fund. If this policy is to be followed in all cases hereafter, revenue from power may furnish part of the funds for building additional works.

New Equipment and Methods May Aid Steel Industry

LATER sessions of the 28th annual meeting of the Association of Iron and Steel Electrical Engineers than could be included in ELECTRICAL WORLD news last week (page 1076) covered the application of electricity to production work and involved studies of the potentialities of electronic and photronic devices for new uses.

A preliminary report, by the control committee, on proposed specifications for full magnetic d.c. controllers was presented by E. L. Upp, National Tube Company. It represented an attack on a very complex problem that has given the steel industry concern for many years. No action was taken on the detailed specifications, but it was unanimously agreed to continue the work in co-operation with N.E.M.A.

The three papers on electronic control devices were referred to by the chairman as covering the most novel group of developments made in a long time and whose ramifications of applications in the future are hardly imagined by their developers.

T. R. Rhea, General Electric Company, pointed out the advantages and limitations and referred to some applications. In using photoelectric cells as pyrometers, he advised using the vacuum type instead of gas-filled, constant voltage supply and well-insulated cable between cells and amplifiers. Among applications mentioned were separating hot billets or slabs of different lengths, limit switches, substitutes for differential devices when used with "Selsyns," automatic screw-down, controlling period of current application in resistance welding without contractors, timing of operations and controlling small d.c. motors driving reels.

A. F. Corby, Weston Electric Instrument Company, explained the nature and characteristics of the "photronic" cell discussed at length in an earlier issue of ELECTRICAL WORLD and said that developments have now been made which enable the cell to give 1.4 to 2.2 micro-amp. per foot-candle, or sufficient to operate relays directly without any auxiliary source of power and with rugged relays.

W. B. Shirk, Westinghouse Electric & Manufacturing Company, directed his remarks chiefly to applications in steel mills and how economy could be effected thereby. Repeater gate operation saved $10,000 a year by reducing cobbling operation of mine doors, avoided slowing down trains and reduced the power for acceleration.

Although no mention of electric heat was made by D. W. Murphy, University of Michigan, in his paper on the influence of atmosphere and temperature on scale losses, the information presented does indicate that a large monetary loss may be avoided with electric heat.

In 1929, he estimates, the losses due to scaling (oxidation) during the soaking period prior to rolling might easily have reached $830,000 to $1,310,000. Even in 1931 these losses probably attained $326,000 to $520,000. In the forging industry alone the losses ranged from $220,000 to $352,000 in 1929 and from $70,000 to $112,000 in 1931.

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West Virginia Commission Initiates Rate Inquiry

Investigations of utility operations with the intention of reducing some of the rates charged are now being undertaken on the initiative of the West Virginia Public Service Commisson.

Although the larger utilities, the commission said in a formal statement announcing the investigation, are earning from 3 to 5 per cent annually on their capital investment, there are a few smaller firms whose profits are "greater than appear to be justified under present conditions."

The commission states that early in the year "it became apparent there was to be no immediate relief" from the present economic conditions, and therefore called upon every utility under its jurisdiction to submit a special report of capital investment, operating revenues, operating expenses, depreciation charges, tax assessments for 1931, etc.

Brief History of the "Electrical World"

The *Electrical World* (published under that name since 1883 and tracing its history back to 1874) is a consolidation of the *Electrical Engineer* (founded in 1882 as the *Electrician*) and the *American Electrician* (founded in 1896). Final consolidation under the title of *Electrical World* took effect on January 1, 1906, the *Electrical World* and the *Electrical Engineer* having been acquired by the McGraw Publishing Company in 1899 and amalgamated as the *Electrical World and Engineer*, and the *American Electrician*, a McGraw monthly, having been absorbed seven years later.

The roster of past editors of the *Electrical World* includes Carl Hering, Louis Bell, W. D. Weaver, T. C. Martin and many other men prominent in the electrical industry—some, like those named, no longer living, and others, like W. H. Onken, Jr., C. O. Mailloux, A. S. McAllister, Frank F. Fowle, F. M. Feiker, D. H. Braymer and H. V. Bozell, still active in engineering and industrial service. L. W. W. Morrow is now editor. Allen M. Perry is managing editor. Other members of the present staff are: Earl Whitehorne, contributing editor; G. F. Wittig, statistical editor; A. E. Knowlton, associate editor; E. R. Searles and E. M. Glennon, assistant editors; F. R. Innes, Western editor; H. S. Knowlton, New England editor; and Paul Wooton, Washington correspondent.

Agitation to Shift Tax on Energy Bills Continues

Scattered shots in a die-hard fight to avoid levy of the newly instituted federal tax of 3 per cent on bills for electrical energy have been heard in Congress and in the Southern states. Many municipal projects have arranged to absorb the tax, but the Bureau of Internal Revenue rules that this will not be permitted.

Senator Norris proposed to have the tax shifted to the electric utility companies by an amendment to a resolution planned for passage by the Senate. This was rejected by the House ways and means committee last week.

Columbia (S. C.) City Council has passed a resolution asking the Railroad Commission to investigate the desirability of having the companies absorb the tax.

Birmingham (Ala.) City Commission has adopted a resolution calling on the Alabama Public Service Commission to adjust electric rates so that the companies supplying the energy will absorb the new tax.

Atlanta (Ga.) City Council and representatives of many other Georgia cities have passed resolutions asking the Georgia Public Service Commission to investigate the possibilities of having the utilities absorb the tax. A statewide organization has been formed to wage a campaign for lower rates.

Representative Crisp of Georgia, acting chairman of the House ways and means committee, in defending the tax measure stated:

> The agitation in connection with the 3 per cent tax on consumers of electricity has created the impression on some minds that the new tax bill exempts the power companies from increased taxes and places them instead on consumers. This is far from true.

Judge Crisp further points out that every tax in the revenue act, such as the tax on gasoline, automobiles, bank checks, postage rates, etc., is passed on to the consumer.

"And these taxes, by the way," he said, "I consider infinitely more burdensome than the tax on electric energy."

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Appliance Sales Vary Widely Among States

Retail household appliance sales are highest per population in Utah and lowest in Mississippi, according to a comprehensive analysis of the major retail markets of the nation just completed by Erwin, Wasey & Company, covering the year 1930. The analysis, said to be the most thorough and comprehensive of its kind ever made in this country, is based upon the first official census of retail sales made by the United States government in connection with the 1930 census.

In the analysis, the retail sales index gives 100 as the average for the country, with Utah retail sales placed at 200, and with the retail sales of Mississippi placed at 29. Among the larger cities, Kansas City, Mo., ranked highest with sales listed at 423 per cent. New Bedford, Mass., ranked lowest, with sales placed at 34, or 66 per cent below average. It is shown that retail household appliance sales are below average in 23 of the 48 states, or in almost half of the country.

In dollars and cents, New York state ranked first in retail household appliance sales, Pennsylvania second, Illinois third, California fourth, Ohio fifth, New Jersey sixth, Texas seventh, Michigan eighth, Missouri ninth, Massachusetts tenth, Wisconsin eleventh, and Illinois twelfth.

New York States sales amounted to $55,554,000, Pennsylvania $40,237,000, Illinois $29,334,000, California $28,620,000, Ohio $25,390,000 and New Jersey $20,734,000. Total sales throughout the United States, the analysis shows, amounted to $425,809,000, of which a little more than one-half was spent in the 370 larger cities of the country.

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Hardware Men Renounce Joint Merchandising Survey

At the annual congress of the National Retail Hardware Association, held last week, a resolution was adopted renouncing the merchandising figures recently released (ELECTRICAL WORLD, March 12, page 473; May 7, page 794) by the electrical merchandising joint committee:

The resolution reads as follows:

The National Retail Hardware Association disclaims authority for the figures recently released by the Electrical Merchandising Joint Committee which purport to show the distribution of electrical appliances by manufacturers to various types of retail outlets.

As these figures do not include sales of manufacturers to wholesalers, and by them to retailers, the study is obviously incomplete and subject to erroneous deductions.

Since the study fails to show a true picture of electrical appliance distribution by outlets, it is the belief of this congress that the figures should not have been released.

For this reason the Electrical Merchandising Joint Committee is requested to make no more use of these figures; to correct, so far as possible, the incorrect interpretation which has been made of them by the press, and to release no more such incomplete studies.

According to H. P. Sheets, managing director of the hardware association, it is felt that

"A survey of outlets can have real value for the electrical industry only when facts are presented. Incomplete facts, as in this case, are not facts, and can benefit no one. But, on the contrary, they can do a good deal of harm.

"When it is indicated that hardware retailers account for 17½ per cent of electric range sales, 12 per cent of electric washing machine sales, only 5 per cent of electric refrigerator sales, and no table appliances, and that such figures reflect only 0.9 per cent of all sales, inaccuracy is definitely shown by the figures themselves."

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Democratic Plank Calls for "Investor Protection"

Plank No. 10 as adopted by the majority of the resolutions committee and presented to the Democratic national convention in Chicago this week reads as follows:

Protection of the investing public by requiring to be filed with the government and carried in advertisements of all offerings of foreign and domestic stocks and bonds true information as to bonuses, commissions, principal invested and interests of sellers. Regulation to the full extent of federal power of:

(a) Holding companies which sell securities in interstate commerce.

(b) Rates of utility companies operating across state lines.

(c) Exchanges trading in securities and commodities.

Pre-Tax Activities Upset Barometers

NO CLEAR picture of business trends as reflected in current figures for the most recent periods available can be had. Some industries rushed into virtually full-time production, some of them even to night work, to produce goods for sale before the new federal taxes should be made effective. Reflected alike in energy production, car loadings and figures for individual industry activities, it is difficult to judge the extent of this influence.

An absence of significant developments in the general economic condition is in evidence. Uncertainty over political developments still offers a psychological hazard to that essential confidence which is necessary to bring about the spending for other than the most needed things on the part of John and Mary Citizen, who remain, as ever, the key to all such problems. It matters little what industry does if John and Mary cannot or will not buy.

Security markets show continued weakness. The financial situation has yet to be fully cleared. Official Washington does not, and has not for a long while, told all that it knows. That is one of the great uncertainties.

Coming Meetings

New England Division, N.E.L.A.—Mount Washington Hotel, Bretton Woods, N. H., July 11-13. Miss O. A. Bursiel, 20 Providence St., Boston.

Camp Co-operation XII—By boat to Bermuda, Aug. 3-8. Society for Electrical Development, 420 Lexington Ave., New York.

Wisconsin Utilities Association—Commercial section, Eau Claire, Wisc., Aug. 25-26. John N. Cadby, 135 W. Wells St., Milwaukee, Wisc.

American Institute of Electrical Engineers—Pacific Coast convention, Vancouver, B. C., Aug. 29-Sept. 2. Middle Eastern District Meeting, Baltimore, Md. Oct. 10-13. H. H. Henline, 33 West 39th St., New York.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 7-9. H. A. Buch, Telegraph Bldg., Harrisburg.

Rocky Mountain Division, N.E.L.A.—Stanley Hotel, Estes Park, Colo., Sept. 12-14. G. E. Lewis, 367 Gas & Electric Bldg., Denver.

Empire State Gas & Electric Association—Saranac Inn, N. Y., Sept. 22 and 23. C. H. B. Chapin, Grand Central Terminal, New York.

Illuminating Engineering Society—New Ocean House, Swampscott, Mass., Sept. 26-30. E. H. Hobbie, 29 W. 39th St., New York.

National Electrical Wholesalers Association—Hotel Statler, Buffalo, N. Y., Sept. 26-30. E. Donald Tolles, 165 Broadway, New York.

National Safety Council—Washington, D. C., Oct. 3-7. W. H. Cameron, 20 N. Wacker Drive, Chicago.

Great Lakes Division, N.E.L.A.—French Lick Springs, Ind., Oct. 6-8. T. C. Polk, 20 N. Wacker Drive, Chicago.

Association of Electragists, International—Kansas City, Mo., Oct. 10-12. L. W. Davis, 420 Lexington Ave., New York.

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New England Utilities Avoid No-Pay Cut-offs

Definite revisions of previous policies regarding customers who fail to pay for their use of energy are being made in various communities. Hartford's certificate plan (ELECTRICAL WORLD, May 21, page 877, and June 11, page 1014) is working out well in relieving distress among unemployed patrons and other New England utilities are following variations of the principle.

In Malden, according to A. B. Tenney, president of the Malden Electric Company, the company co-operates with local welfare boards in its territory and its own employees are required to inform its personnel representative or credit manager of cases of destitution. In Malden the city welfare department includes an allowance for gas and electric service in disbursements for the unfortunate. So long as a destitute family makes small payments, principally weekly, and does not allow the original balance to increase, the company makes a practice of maintaining the service.

To secure payment of overdue electric service bills without discontinuance of energy supply the Lubec (Me.) Water and Electric Department has established a deferred payment agreement which, according to J. W. Mitchell, manager of the department, provides for regular payment of past due accounts on the first day of each month until the bill is liquidated, the later bills accruing during the months required for clearing up back payments being paid at the rate of two per month until the customer is again free from indebtedness to the department. In case of default the service is cut off with the usual penalties.

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Industry Interdependence West Coast Meeting Theme

With a program which emphasized the interdependence of all industries as well as the three members of the industrial team—labor, capital and management—the Pacific Coast Electrical Association held its sixteenth annual convention at the Hotel Huntington, Pasadena, Calif., recently. Registration exceeded 500, including most of the industry's leaders in that section.

President A. B. Day, who is president of the Los Angeles Gas & Electric Corporation, sounded the keynote for the addresses and discussions to follow when he said: "America has builded a great industrial machine which can be operated effectively, but at the same time it has developed an economic and social machine which appears to run wild. The electrical industry must assume its share of the responsibility in co-ordinating these two."

One feature of the convention was a session in which leaders of four major California industries, railroads, motor transportation, citrus and oil, presented their major problems in relation to the basic economic picture. The electrical industry, through its intimate contact with all phases of American life, they expected to exercise leadership.

One session was devoted to self-analysis within the industry at which proved industry leaders critically scrutinized policies, problems and trends. F. B. Lewis, vice-president and general manager Southern California Edison Company, Ltd., defined public relations as conducting a business so that everybody is satisfied with its two basic elements, service and rates. Service now being satisfactory, he urged interpretation of rates in terms of consumer's use and simplification of rate structures.

W. E. Houghton, vice-president and treasurer Los Angeles Gas & Electric Corporation, urged that the electric industry be on the alert to interpret future trends, indices of which are already apparent. Among these are the tendency for centralization, the slackening of the rate of population growth and the tendency toward a revival of home life within the community.

Commercial men discussed ways and means of increasing the drive for domestic business, urged that a joint study with engineers and accountants be undertaken to determine the value to the power companies of various classes of business, starting with the electric range, and announced the preparation of a sales manual and handbook on air conditioning for use by sales engineers and contractors. Engineers continued to investigate their problems from the economic angle, with special reference to the mounting production cost in face of decreasing revenue per kilowatt. Major H. S. Bennion, engineering director N.E.L.A., urged engineers to turn to studies of wiring, competitive power, economic cost surveys and operating schedules as fields where improvement is needed.

R. E. Fisher, vice-president in charge of public relations and sales Pacific Gas & Electric Company, was elected president of the association for the coming year, with W. C. Mullendore, executive vice-president Southern California Edison Company, Ltd., and A. H. Markwart, vice-president in charge of engineering Pacific Gas & Electric Company, as vice-presidents.

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Attitude of Utilities on Small Appliances

The electric heating appliance manufacturers during the past two or three years have found that there has been a decline in sales of the small heating appliances beyond that which was to be expected even when taking fully into account the downward trend of sales of this general class of commodity, according to a recent release by N.E.M.A. In order to secure data which would be useful in analyzing this situation a questionnaire was sent to merchandise managers of utility operating companies and to several merchandise managers for syndicates.

One hundred and ten replies indicated that 65 per cent of the utility companies did not believe that the large appliance business interfered with the promotion of small appliances. A full realization of the value of the small appliances from the load revenue viewpoint was evidenced by an affirmative answer of 89 per cent to the question "Is the sale of small appliances desirable from the load revenue viewpoint?" Sixty per cent of the utility companies indicated that they intend actively to promote the sale of small appliances. Some of the companies will sell the small appliances through dealers, others expect to gain the revenue lost by not pushing sales through the sale of large appliances and a few companies are planning to promote the sale of large appliances and to encourage the dealers to promote the sale of small ones.

Full Reports Interest Few, Says Associated Head

In a letter addressed to newspapers, H. C. Hopson, vice-president of the Associated Gas & Electric Company, replied to some of the attacks which recently have been made on large corporations. Commenting on the criticism that business corporations have quite generally adopted the practice of depriving security holders of proper financial information, he said:

It is my experience that corporations, instead of withholding information, usually published far more than the vast majority of security holders care to have. . . . Earlier in the year the Associated Gas & Electric Company published a condensed annual report . . . and distributed more than 229,000 copies to all of its registered security holders whose names and addresses were known. You will be surprised to learn that we have received to date only 61 requests for copies of the complete report out of nearly a quarter of a million security holders, which apparently indicates that instead of receiving too little information the majority of individuals are entirely satisfied with less than they could have for the asking. . . .

Mr. Hopson cited similar experiences of the New York Central Railroad and the United States Steel Corporation.

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Common Dividends Cut by Insull Companies

James Simpson, new chairman of the board of the utility companies formerly headed by Samuel Insull, has announced quarterly dividend reductions for the Commonwealth Edison Company, the Public Service Company of Northern Illinois and the People's Gas Light & Coke Company. For the Commonwealth Edison and People's Gas dividends of $1.25 are payable July 15 to stockholders of record July 5. The Public Service of Northern Illinois dividend is 75 cents. The companies have been on an $8 annual basis. Preferred stock dividends are to be maintained.

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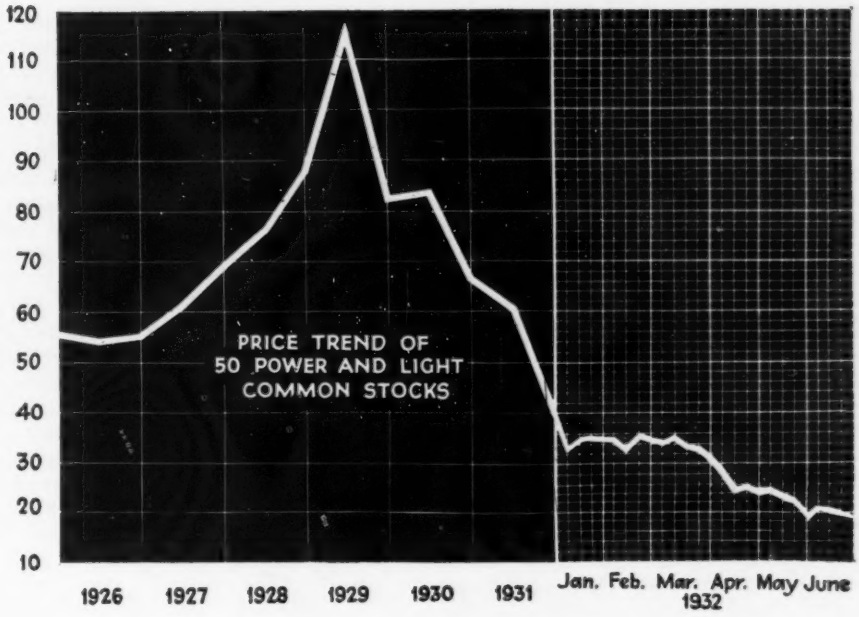
New Utility Financing Meager in 1932

New financing continued on a slender scale during the month of June, market conditions not being favorable for the floating of even superior issues. Only three new electric light and power offerings were made, and two of these issues, as indicated by the accompanying table, were in the form of short-term notes. It is interesting to observe that the proceeds from these new 6 per cent note issues are to refund note issues bearing interest at only 4 and 4½ per cent.

For the six months ended June 30 public offering of electric light and power issues amounted to only $157,610,800, as compared with $973,945,000 for the similar period of 1931. This shrinkage in volume was not characteristic of the light and power industry alone. Figures compiled by the *Commercial & Financial Chronicle* show that for the five months ended May 31 all new corporate securities declined sharply to $220,483,295, from a total of $1,777,428,411 for the similar period of 1931.



Utility Stocks and Bonds Lower

Electric light and power stocks lost some ground during the past week, the "Electrical World" index receding to 18.5, from 19.8 the preceding week. The bond list was somewhat irregular, but losses prevailed over gains and carried the index down to 83.5 for June, as compared with 85.0 in May.

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Name of Company	Amount of Issue (Par Value)	Period (Years)	Class	Purpose	Interest Rate	Price	Per Cent Yield
California Oregon Power Co.	$4,000,000	10	Refunding mortgage gold bonds	Additions and other corporate purposes	6½	93	7.50
Wisconsin Valley Electric Co.	4,000,000	1	Notes	To refund maturing notes	6	99	7.05
Wisconsin Public Service Corp.	2,500,000	1	Notes	To refund maturing notes	6	99½	6.52
Total	$10,500,000						

Portland Utility Officers Defend Holding Companies

The second phase of the rate hearing of the Northwestern Electric Company, Portland, before E. H. Thomas, Oregon Public Service Commissioner, which closed recently, was devoted largely to the presentation of the company's case based on points developed by the commissioner in the first phase of the hearing (ELECTRICAL WORLD, April 30, page 757). Chief subjects of testimony were the management contract between the Northwestern Electric Company and the Electric Bond & Share Company, valuation of the Northwestern company and the basis on which the company's property might be split between Oregon and Washington for rate-making purposes.

The case for the Bond & Share management contract, on which the Northwestern Electric Company pays at 1½ per cent of gross earnings some $55,000 annually, was built around the value of the service rendered to the supervised company and the cost to the supervising company of rendering the service.

Vice-presidents L. T. Merwin and J. A. Laing of the Northwestern Company defended holding-company control, Mr. Laing referred to the financial advantages received by his company from the American Power & Light and Electric Bond & Share, maintaining that the financing of various improvements over the past five years could not have been accomplished without holding-company facilities and adding that the existence of $3,000,000 of unfunded debt now owed to American Power & Light on account of property additions and betterment would present a serious financial situation if owed to ordinary banking institutions.

The commissioner took the case under advisement, indicating that he would soon hear arguments preparatory to issuing any order.

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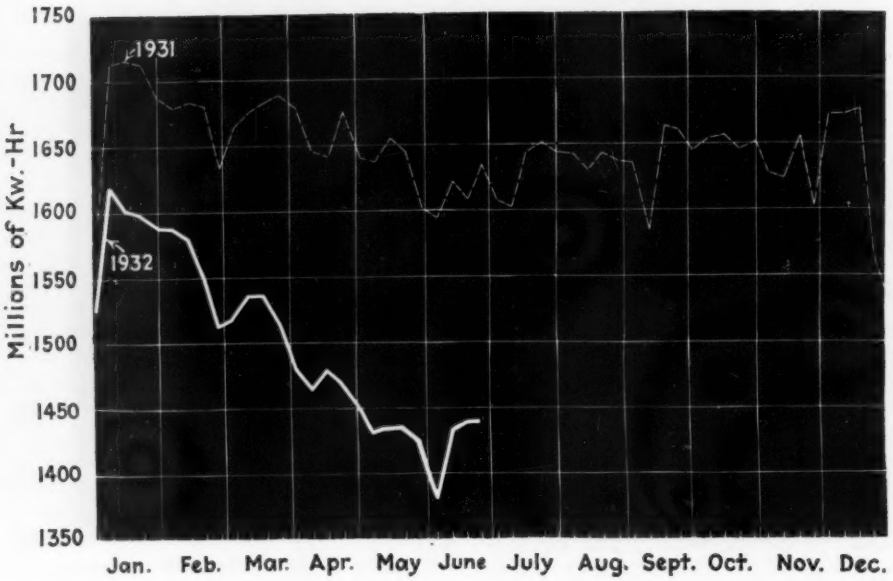
Three Weeks of Steady Output



WITH an output of 1,440,541,000 kw.-hr. for the week ended June 25 central-station operations continued at a level that has been approximately constant for three consecutive weeks, according to estimates announced by the National Electric Light Association.

That the deficiency compared with 1931 is a little greater than it was a week ago, 11.9 per cent against 10.5 per cent, is due to a slight rise in 1931 and not to any appreciable recession in 1932. This circumstance must be taken into account when comparing the regional changes, all of which show a greater departure from 1931 than in the week of June 18.

Compared with the week of June 11, however, conditions on the Atlantic Seaboard and in the Middle West are unchanged, New England made a distinct gain and a slight decline is indicated for the Pacific Coast.

Weekly Output, Millions of Kw.-Hr.

Week Ended	1932	1931	1930	1929
June 25	1,441	1,635	1,704	1,723
June 18	1,442	1,610	1,698	1,703
June 11	1,435	1,621	1,707	1,699
June 4	1,381	1,594	1,657	1,690
May 28	1,425	1,602	1,660	1,615

Per Cent Change from 1931

Region	Week Ended June 25	June 18	June 11
Atlantic Seaboard	— 9.5	— 6.3	— 9.0
New England alone	—10.8	— 9.5	—13.5
Central industrial	—14.2	—12.7	—14.3
Pacific Coast	— 9.6	— 7.6	— 8.9
United States	—11.9	—10.5	—11.5

300,000 Kw. in Heaters

"Approximately 300,000 kw. in small electric unit heaters is sold in the United States every year. This equipment consumes about 600,000,000 kw.-hr. annually. The majority of small electric heating units range in size from 40 to 5,000 watts and offer an unusually attractive load for the utility."

The preceding statement is quoted from a report of the industrial heating committee, Commercial National Section, of the N.E.L.A., and indicates a steady increase in the industrial heating load, even if allowance is made for replacements. It indicates also a growing appreciation of the advantages of applying heat electrically. The report lists some 174 suggested applications.

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Electric Sign Opportunities Neglected, Survey Shows

Efforts to interest summer visitors to the northeast in industrial products manufactured in that section include a questionnaire survey of sign installations under the auspices of the New England Council. Recently tabulated results reveal that 10 per cent of 239 factories replying are still without signs bearing the company or firm name on the plant, 16 per cent of the signs on 221 plants are not easily visible from the highway, 50 per cent of 132 installations are not in clear view from the nearest railroad and 46 per cent of 145 factories fail to show the product name, trademark or brand. Only about four factories out of 30 invite travelers to visit the plant by signs easily seen from the highway, and 51 per cent out of 131 concerns have no display of products at their plant. Electric sign makers and dealers in New England are planning to take advantage of this survey in co-operation with the power companies.

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Electrical Industry Code Saves Telegraphic Charges

Under the sponsorship of the National Electrical Manufacturers' Association there was undertaken in July, 1930, in collaboration with seven major electrical industry associations, the formulation of a telegraphic code which would establish uniformity and savings in telegraphic communication for all elements of the industry.

This code, known as LCODE, was released in November, 1931, and a report upon its success in accomplishing the desired objectives has just been made by the N.E.M.A. committee responsible for it. According to the committee one large manufacturing company, operating at 60 per cent capacity,

shows an average saving on communications between the main factory and three sales offices of 34 per cent since last November, a saving of $23,000. A second large company under 50 per cent operation saved nearly 28 per cent in similar service, or about $14,000.

Several smaller companies report using LCODE for about 50 per cent of their interoffice telegraphic communications. More than 300 organizations are said to be using the code at present.

▼

Non-Metallic Extensions Receive Code Approval

By the customary interim revision procedure of securing two-thirds membership acceptance for new methods there now appears in the National Electrical Code provisions for certain non-metallic extensions. This action, secured on the application of Electrotrim, Inc. (ELECTRICAL WORLD, May 21, 1932, page 881), permits the use of a semi-permanent form of surface wiring for use in place of the customary extension cords.

The provisions of revised Section 516, Article V, of the National Electrical Code provides, in abstract, that:

(a) Semi-portable two-wire assemblies approved for the purpose may be used as extensions to existing convenience outlets on lighting or appliance branch circuits only in exposed dry locations.

(b) Attachment of such extensions to existing convenience outlets shall be by plug connectors approved for the purpose.

(c) Such extensions shall be attached only to the surface of interior woodwork or plaster finish and shall not be installed as concealed wiring or run through floors or partitions or be installed where subject to moisture or corrosive vapors, nor in contact with any conductive material.

(d) Such extensions shall not be made on circuits of over 150 volts.

(e) Individual extensions shall not be longer than 20 ft., may contain a maximum of three receptacles provided that the total outlets on the branch circuit are not over 12.

(f) Such assemblies shall be secured between outlets to the surface wired over by tacks, screws, small nails or other approved means at intervals of not more than 6 in. . . .

(g) Receptacles and other fittings shall be of approved type and be secured to the surface wired over by suitable screws. . . .

(h) Such extensions shall be made in continuous lengths without joint, splice, tap or exposed bare conductors.

▼

Major New Construction This Week

BIDS are being asked until August 2 by city purchasing agent, Los Angeles, Calif., for one 81,250-kva. turbo-generator unit, with accessories, for new municipal power plant (Specifications 2827); also, two steam-generating units, 1,400 lb. pressure per square inch (Specifications 2826).

Machine drives, motors, conveyors, etc., to be installed in new mill of New Braunfels Textile Mills, at New Braunfels, Tex. Cost over $125,000. Company being organized.

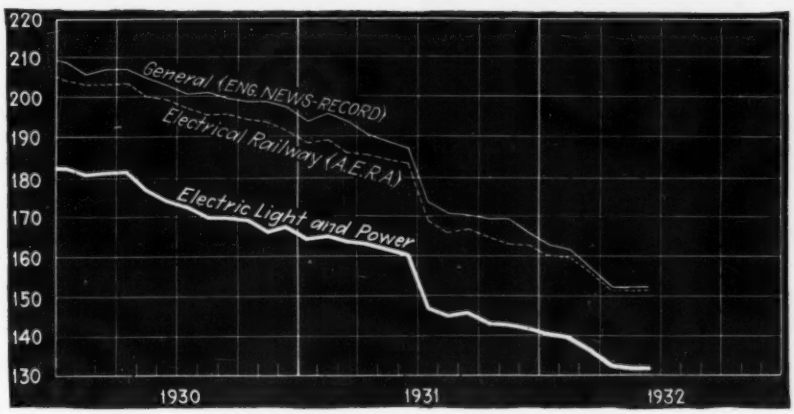
Until August 3, bids are being aked by United States Engineer Office, Rock Island, Ill., for power house and lock-operating equipment, including control system, Mississippi River Lock and Dam No. 15 (Circular 168).

About $50,000 will be expended by Lexington Utilities Company, Lexington, Ky., for equipment replacements and rebuilding of power plant, recently damaged by fire.

Construction of a municipal system with complete equipment including power house and distributing facilities, is asked for in bids closing July 20 by Board of City Commissioners, Piqua, Ohio. Appropriation of $700,000 made for entire project.

A $40,000 expansion and improvement program will be carried out at power substation of Southern California Edison Company, Los Angeles, Calif., at San Bernardino.

Costs Apparently Stabilizing



AFTER a long-continued decline construction costs in the electric light and power industry have for the past few months remained nearly constant, although the trend is still slightly downward. The index for June is 18 per cent lower than it was a year ago and 29 per cent under the peak figure in 1929.

In contrast with 1932 the summers of 1930 and 1931 included very definite declines; in the early summer of the former year there was a sharp decrease and another in midsummer of 1931. With these the decrease from February to April of the current year may be compared. While it is yet too early to assume, on the basis of these various considerations, that the decline has run its course the recent figures at least suggest the possibility that this may be the case.

The series of construction indices from 1913 to 1931, inclusive, was published in the ELECTRICAL WORLD of February 13, 1932, on page 318.

Construction Cost Indices: Electric Light and Power, Electric Railway and General

Base: 1913 = 100

	Electric Light and Power*	Electric Railway*	General — *Engineering News-Record*
June, 1932.....	131	150	152.2
May, 1932.....	132†	151	152.8
April, 1932.....	132	151	153.1
March, 1932....	136	156	157.2
June, 1931.....	160	184	187.2
Last 5 yrs. high	184	206	210.4
Month.....	Apr. '29	Nov. '28	Feb. '29
Last 5 yrs. low	131	150	152.2
Month.....	June, '32	June, '32	June, '32

*Computed by Albert S. Richey.
†Revised.

British to Refine Own Electrical Copper

A noteworthy development in the British cable industry is the establishment of an undertaking, closely associated with British Insulated Cables, Ltd., under the title of British Copper Refiners, Ltd. The company has been formed with a capital of £120,000 ($600,000) and will produce high-conductivity copper for electrical wire manufacture.

The refinery will be the first works of its kind in the country and will be located at Prescot, Lancashire, close to the British Insulated Cable Works. The initial maximum output of the plant, which will be of the most modern type, will be 1,125 tons per week, but provision will be made whereby extensions can be carried out. It is expected that the plant will be in operation toward the end of the year.

▼

New York Metal Prices

	June 23, 1932 Cents per Pound	June 30, 1932 Cents per Pound
Copper, electrolytic....	5.33	5.33
Lead, Am. S. & R. price	3.00	2.95
Antimony.....	5.00	5.00
Nickel, ingot.....	35.00	35.00
Zinc, spots.....	3.12½	3.05
Tin, Straits.....	19.70	19.60
Aluminum, 99 per cent.	23.30	23.30

Rehearing for Free Lamp Case

Following a decision of the Cook County Circuit Court (ELECTRICAL WORLD, May 21, page 880) to the effect that energy rates which include free lamps are illegal, the case of Commonwealth Edison versus Consumers Sanitary Coffee & Butter Stores was carried to the Supreme Court of Illinois, which upheld the Circuit Court. The case has been referred back to the Illinois Commerce Commission for rehearing, it being charged that the findings of the commission were contrary to evidence and its order unreasonable and unlawful.

▼

Westinghouse Omits Dividend

Directors of the Westinghouse Electric & Manufacturing Company have omitted the dividend on the common stock, but declared the usual quarterly dividend of 87½ cents a share on the $50 preferred stock at their meeting on Wednesday. Three months ago the same preferred dividend and a common dividend of 25 cents a share were declared.

▼

Air Conditioning Work to Begin

Announcement has been made by the General Electric Company that its newly organized air-conditioning department will begin operating in the latter part of July in 25 cities along the Atlantic seaboard. J. J. Donovan is manager.

▼

Beauharnois Bond Sales to Continue

On the ground that it would be unfair to tie up the financing of the Beauharnois Light, Heat & Power Corporation simply because the Transportation & Power Corporation wants an accounting from it, Justice Boyer, in Practice Division of the Superior Court, refused to issue an order to the Canadian Bank of Commerce to stop handling Beauharnois bonds. In its main action the Transportation & Power Corporation attacked the validity of two trust deeds and debentures issued by the Beauharnois Corporation and asked that the Canadian Bank of Commerce, together with twelve other financial houses, be ordered to cease buying or selling the debentures.

▼

Underwriters' Label Re-examination

There are many devices and materials listed by Underwriters' Laboratories to which its label service form of inspection is not applied but which are inspected under the laboratories' re-examination service. In order to provide for devices and materials under its re-examination service a positive, convenient and immediately available means of determining whether or not a device or material is listed the laboratories have now made available, for use under suitable regulation, a marker to be applied to such goods, which states "Listed under Re-examination Service, Underwriters' Laboratories."

▼

Commonwealth & Southern Reduces Capital

At the annual meeting of stockholders of the Commonwealth & Southern Corporation held June 15 the retirement of 337,682 shares of common stock owned by the corporation was authorized and the reduction of its capital by $5, the stated value, for each of said shares so retired.

▼

Oregon Grange for Split Taxes

The Oregon State Grange, in annual convention, adopted resolutions recommending that the Governor instruct the Legislature to enact no laws providing for the taxing of publicly owned utilities; that his administration stand firmly for state ownership and absolute control of water power resources, and that he exercise the influence of his office in support of the new initiative measure being sponsored by the grange which provides additional authority for the state to develop hydro-electric power. The grange's action relative to the tax-free status of publicly owned utilities is in direct controvertance with the administration's recorded demands that all utility properties, whether private or public, must be represented upon the tax rolls of the state.

▼

Ohio's Power Tax Stands

Constitutionality of the Espy-Roberts act, Ohio's relief measure which increased the excise tax on public utilities for the next five years, has received the approval of the Ohio Supreme Court in a friendly test suit (ELECTRICAL WORLD, April 9, page 636).

▼

Coeur d'Alene Decision Appealed

Municipal ownership won the first round in the court battle over the recent municipal ownership plan approved by the voters of Cœur d'Alene, Idaho, when Judge Hodge of Moscow denied an injunction to restrain the City Council from proceeding with the plan. The decision has been appealed. The plan approved at the election held January 19 called for the establishing of a municipal light and power system and a municipal water system, the cost to be defrayed by the sale of bonds, which would be retired solely out of revenue from the projected plants.

Alabama Power Must Pay

Said to be the largest judgment ever rendered in a Jefferson County, Alabama, court, the Alabama Power Company has been ordered to pay $185,387 to the Bosworth Smith Company for damages alleged to have been suffered when the power company raised a floodgate at Lock 18 on the Coosa River in 1929, releasing a flood of water which swept away a cofferdam and equipment used in constructing a bridge at Wetumpka. The plaintiffs claimed actual damages of $176,000 and punitive damages of $250,000. The power company has indicated the intention of appealing to the Supreme Court.

▼

Electric Power & Light Defers Dividends

The directors of the Electric Power & Light Corporation have taken no action on the declaration of the common and second preferred dividends due at this time. "In view of present business conditions reflected in declining earnings," a statement by the company reads, "it was believed to be to the best interest of the stockholders to conserve a strong cash position."

▼

San Joaquin Case Closed

Petitions for a rehearing of the San Joaquin Light & Power Corporation rate case (ELECTRICAL WORLD, June 25, page 1075) were denied last week by the California Railroad Commission. The company, with Midland Counties Public Service Corporation, had asked the commission to review the facts presented, contending that the decision, which ordered a reduction of $650,000 in rates, was erroneous in that it would constitute confiscation. The power companies may carry the case to the federal court. Talk of acquisition by the city of Fresno of the utility's system bore no fruit.

▼

New River Project Up Again

Application has been made to the Virginia State Corporation Commission by the Appalachian Electric Power Company for a license for the long-contemplated $12,000,000 hydro-electric development on New River. The commission set July 28 for a hearing. The application, drawn in compliance with the provisions of the water power act of Virginia, is entirely voluntary, since the development is exempted from the requirement of obtaining a license.

Construction of this hydro-electric development has been prevented for a period of six years by the inability of the Appalachian Electric Power Company to obtain permission from the federal government to proceed with the construction of this dam (ELECTRICAL WORLD, March 26, page 562).

Electricity Sterilizes Soil Economically

Experiments are now well under way at the Entomological Laboratory, U. S. Department of Agriculture, Sumner, Wash., on soil sterilization which may develop an entirely new application for electricity in agriculture. The idea being worked out embodies the principle of using the soil itself as the resistance in the circuit to develop the heat required. Charles Wildebour, Puget Sound Power & Light Company, Seattle, originated the idea and the experiments are being carried out by C. F. Doucette, in charge of the station, in co-operation with the engineering department of the company.

Copper blades 5 in. deep arranged in vertical parallel planes form the terminals of an ordinary 220-volt circuit. When inserted in the moist soil to be sterilized the circuit is completed with the soil acting as the resistance and the temperature rise starts. Different spacings of the parallel terminals determine the length of time it takes to raise the soil from normal temperature to 180 deg. F., which is the temperature needed to kill the harmful bacteria.

With the blades spaced 2 in. apart, 0.628 cu.ft. of soil was brought to 180 deg. in 4½ minutes during which the load varied from 3 to 6 kw. and the current consumption was one-third kw.-hr. With the blades 4 in. apart the same effect was produced in 22½ minutes, with the load reaching a maximum of 1.8 kw. Other spacings and arrangements of the blades are being tried out to secure as nearly as possible a uniform temperature rise throughout the volume of soil treated.

If and when the experiment proves that a practical application of this principle can be made bulb growers will be able to make economic use of the device since they now either have to let the soil lie fallow for three years or undertake expensive methods of sterilization by steam. Cost by steam is said to be 10 cents per cubic foot, while the experiment at Sumner would indicate that the cost by using electricity would not exceed 2 cents per cubic foot under rates uniformly existent in the western Washington territory.

▼

A.S.T.M. Specifications for Transmission Cable

At the thirty-fifth annual meeting in Atlantic City last week committee B-1 of the American Society for Testing Materials presented proposed tentative specifications for hard-drawn copper transmission cable. The standard covers bare concentric-lay cables of nineteen strands or less composed of copper wires laid helically about an axis of one or more layers. This provides that, in brief, copper shall be of A.S.T.M. designation B 4 or B 5; wires shall be continuous throughout without splices, joints or brazing; pitch of outer strands shall be not less than twelve nor more than sixteen times the diameter of the cable; lay of inner wires shall be opposite to that of the outer strands; thirteen cable sizes of various characteristics are allowed; variations of tensile strength shall not exceed 5,000 lb. per square inch; test procedures and routines are also defined; resistivity shall not exceed 902.27 lb. per mile ohm at 20 deg. C. or, in the case of soft or annealed core, 884.08 lb. per mile ohm, and finished lengths shall not vary more than 5 per cent or cross-sections shall not be more than 2 per cent under areas specified.

▼

Generator-Turbine-Pumps Used for Storage Hydro

Recently placed in operation, the new 197,000-hp. Schluchsee-Häusern pumped storage hydro station in Germany offers some interesting features. In the power house are four power sets, each consisting of three elements, vertically mounted, generator, turbine and pump, as named, from top to bottom. The high-head Francis turbines are each rated at 49,300 hp. Each pump has a maximum rating of 26,700 hp. The pumps and turbines on each set are connected to one of two pressure pipe lines through a branch pipe which can be shut off by a spherical valve.

A large storage reservoir was formed by building a dam across the Schluchsee and a conduit connects the lake-reservoir with the Schwarza Valley. The power house is about 200 ft. below the Schwarza dam.

At times when the demand for energy is low the pumps in the power house are driven by the unneeded energy and pump water from the Schwarza reservoir into the Schluchsee. When the demand for energy is heavier flow is reversed through the same pipe line to drive the generators. The generator-turbine-pump units were provided by the Escher-Wyss Engineering Works.

Previous pumped storage projects of note were the Niederwartha development in Germany and the Rocky River plant of Connecticut Light & Power.

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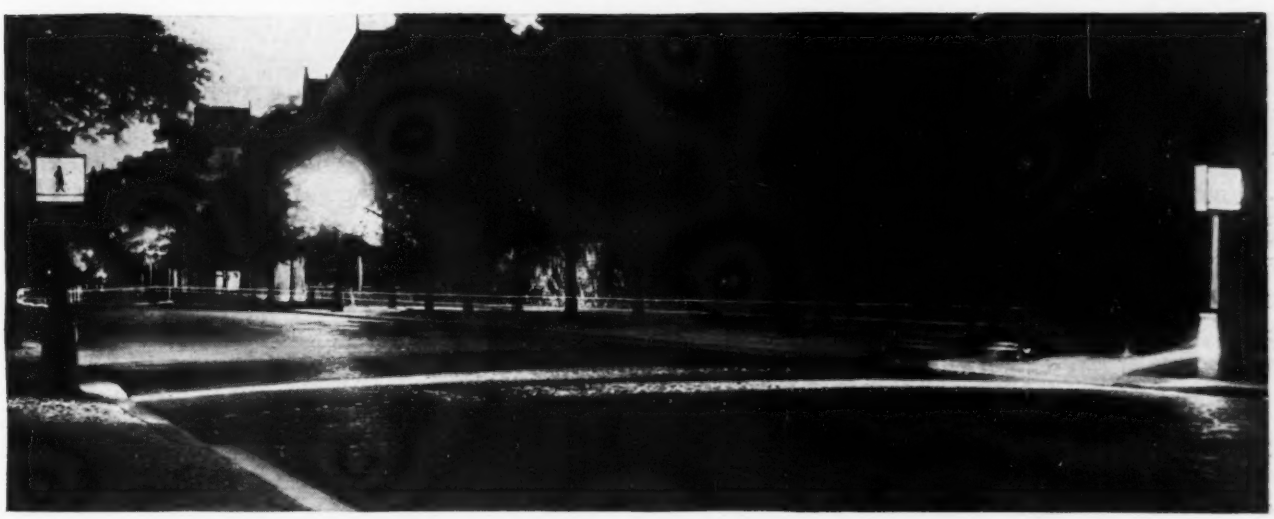
PARIS ADOPTS LIGHT-GUIDED STREET CROSSINGS



Safety passages for pedestrians formed by combination lighting standards which both throw a beam of light upon the street and bear an illuminated sign to serve as a warning, in mid-block areas, to drivers are the most recent innovation in pedestrian protection in Paris, France. Sharp and unmistakable relief against a dark background is said to be obtained.

EDITORIALS

L.W.W.MORROW
Editor

An example of courage and enthusiasm

EIGHT hundred delegates attended the Association of Iron and Steel Electrical Engineers' convention in Pittsburgh, June 20-24, 44 exhibitors displayed their products and 1,400 visited the exhibits. Considering the fact that the iron and steel industry is operating at 16 per cent of capacity, and should have more reason to cut expenses than other industries, this demonstration puts to shame the attendance at utility conventions and the lack of sales aggressiveness shown by some electrical and allied manufacturers.

The companies that are sending delegates to conventions and committee meetings are to be commended for their refusals to submit to the fear complex and they will receive their reward in the fruits of these meetings. The manufacturers who refuse to relax their sales efforts just because buying is curtailed and continue to participate in exhibits are the loyal ones who should be favored when buying is resumed. Engineering staffs are more interested than ever before in equipment which will effect plant economies and assure quality production or uninterrupted operation at the least over-all expense. They are interested chiefly in ways of getting the most return out of existing investments. Not being rushed to complete any jobs now, the engineers have more time to analyze the value of ideas and are particularly receptive to any suggestions which they can adopt as soon as business ceases its decline. Depreciation of unused equipment or that operated under abnormal conditions will certainly require replacement buying shortly.

But getting back to utilities themselves and the attendance of their men at conventions and committee meetings. They don't, as some holding company groups believe, have a monopoly on the worth-while ideas that can be put into execution. Ideas do not come out of groups that think as one, but out of meetings where diverse opinions and experiences are related. New ideas are stimulated by mixed groups which do not adhere to the same standards and practices and whose freedom of thinking is not warped by a company policy. The managements of steel mills apparently recognize this advantage, judging from the convention attendance of their engineers, despite the fact that they are often accused of secretiveness.

Conventions, committee meetings and sales effort are needed as never before, but more thought must be given to adapting the programs and appeals to immediate problems. Let's take a lesson from steel mill engineers' demonstration of courage and enthusiasm.

Ripley suggests uniform reports and publicity

THERE is little objection to the idea of Professor Ripley for enforced standardization and publication of utility corporation financial reports. Publicity of accounts would give both the genuine investor and the legitimate corporation firmer ground to stand on and might serve as a check to both speculative investors and stock-manipulating corporations. At the present time there is little standardization in utility annual reports, especially those presented by holding companies, even though an accountant finds but slight difficulty in arriving at complete facts.

A second suggestion of Professor Ripley is that publicity of the holdings of corporation executives and directors would be effective in bridging the gap between owners and managers. This gap

is often wide in the large corporation, but we doubt if publicity alone will solve the intricate problems associated with diversified stock ownership found in modern corporations. In less degree than ever before is it possible for executives and directors of corporations to maintain ownership of their enterprises—they are becoming managers for a large group of stockholders. It is impossible for these stockholders to act intelligently on corporation business affairs and they must rely upon the integrity of their corporate managers rather than upon their ability to analyze financial statements, however detailed these may be. Complete publicity of stock holdings and uniformity in financial statements, however, would aid the development of better stockholder-manager relations and would make easier the measurement of relative investment values in corporation securities.

Simplified wiring approved

A FORM of wiring which involves little material or installation expense has just recently been approved by the electrical committee of the National Fire Protection Association for surface extensions from existing outlets under certain restrictions indicated in Section 516, Article V, on non-metallic surface extensions.

This code approval, effected by the customary interim revision procedure of securing two-thirds membership acceptance of new methods, gives a partial answer to the criticism sometimes raised that the cost of installing additional convenience outlets has handicapped the sale and convenient use of household appliances. It also makes it less attractive for the public to drape lamp cords around the baseboard and across floors where they may become a hazard, and does so without skimping on circuit capacity or imposing a new hazard. In fact; with the construction approved and with the restriction in length of extensions or number of outlets per circuit, the safety is apparently greatly increased over so-called "bootleg" wiring.

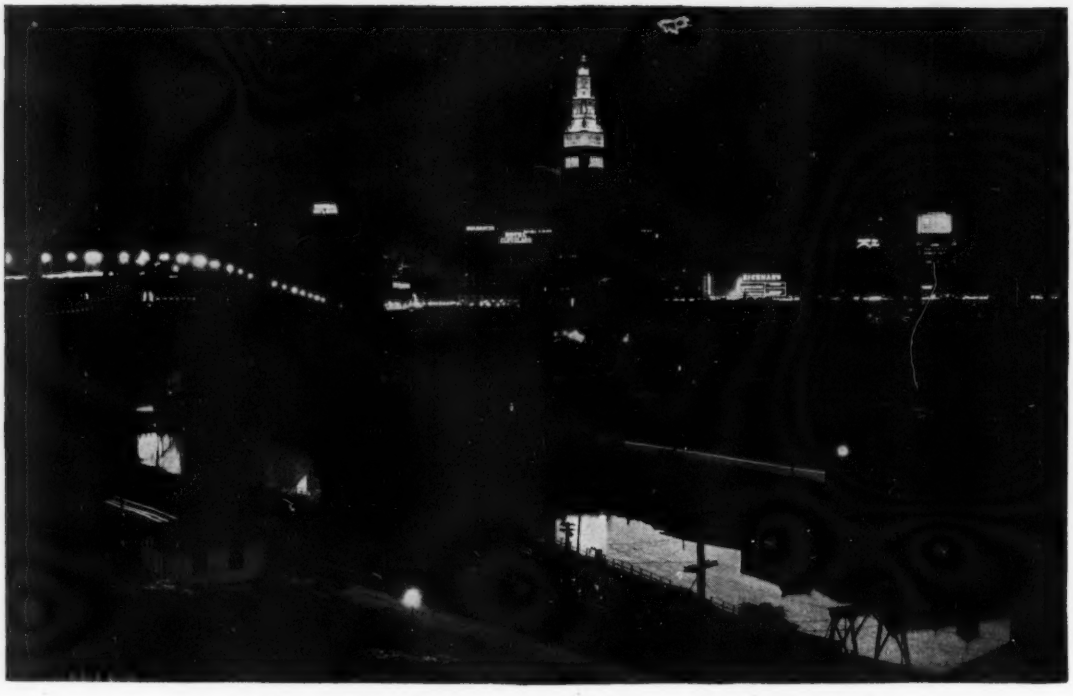
Although the labor required for installation is greatly reduced from that for concealed wiring in old houses, and may therefore be considered objectionable by some contractors, the newly approved form of extension wiring should be an aid to them in securing a volume of new wiring business which may lead to rehabilitation or amplification of existing wiring. Anything that increases the adequacy of wiring and outlets should be a help to manufacurers and dealers selling household devices. And increase of domestic business will benefit manufacturers of all equipment used in generation, transmission and distribution of electricity.

Sitting on a bonanza

IS THERE any use waiting longer for some economic Red Cross to come to salve our wounds, bind up our fractures, console and cheer us on to convalescence? It is time some one rose up and with a shout of confidence stirred the surrounding throng to new hope and revived endeavor. Some one certainly should see in retrospect the firm foundation which the electrical age laid for the last twenty or more years of wholesome comfort and affluence. He should see as lucidly in prospect the triumphs to come from top-to-bottom exploitation of the half-sensed potentialities of electricity. America was, is and shall be more electrically conscious.

Must industry alone have forever a monopoly of the beneficent contributions of electrical science? No, and when America wakes up it will demand that the home be brought to parity with industry and commerce. Look at today's home with its smattering of comforts and compare it with the multifarious applications in industry. Look at the hotel kitchen and compare it with the home kitchen. There is no comparison. Look at commercial lighting for decent vision, for safety and for health and see how abysmally the home compares. Look at the immense possibilities for purifying and invigorating the atmosphere where we spend most of our lives—the home—and compare the failure to realize them with what has been done in spaces where we spend a few fleeting hours. Look at the boundless possibilities of electrical methods and equipment to do all manner of effort-saving things for the home as they have just begun to do for industry.

Imagine how "keeping up with the Joneses" will accelerate the new era when it once gets started. It takes no effort at all to envision an absolutely vertical rate of obsolescence for the present American home. Who will get the spirit of this golden opportunity, shout his message from the housetops and start the rush to the new bonanza?



A.I.E.E. Sifts Protection, Vibration and Communication Practices

WELL over a thousand were in attendance at the Cleveland meeting of the American Institute of Electrical Engineers last week, a registration nearly double the anticipated magnitude. That, however, was not the only index of a zeal and an enthusiasm to do the present task and do it vigorously. No spectacular drawing cards were on the program by way of phenomenal electrical developments. The program was made up of an unusually well-diversified set of topics and discussion was extensive. Educational problems were back for discussion after an omission of several years in a session under the sponsorship of Prof. R. E. Doherty. Professors were there in force in spite of the concurrent meeting of the S.P.E.E. in the far West and this was an encouraging sign of vitality in educational circles.

Among other topics which aroused active interest was a discussion of the proper basis of assigning impulse ratings to transformers in connection with the programs of insulation co-ordination. Conductor vibration of both the high-frequency low-amplitude and low-frequency high-amplitude varieties came in for theorizing and recital of experiences. New developments in relaying and other protective and metering devices aroused considerable interest. Relaying was sensed as getting more and more complex and there seemed to be a growing sentiment that simplification might be found in a reversion to the pilot-wire scheme, this being made generally possible by adaptation of carrier-current schemes for certain of the longer distance problems.

Professional problems confronting the engineer and the engineering societies engrossed the attention of the delegates to an extent that subordinated the usual discussion of section and district activities. Prominent among these topics was the rapid spread of engineer licensing and registration laws among the states. The matter has manifestly reached the national stage and it was evident to those who listened to the discussion that engineering societies and engineers individually can no longer safely ignore the trend. On the contrary, it looks as if it would be necessary to co-operate promptly in this movement in order that civic requirements for engineering practice shall be in accord with the professional ethics and aims of the societies as well as correlate with the curricula in engineering schools.

Co-ordination and impulse ratings

It cannot produce a well-balanced and economical system design if manufacturers are to establish transformer insulation at a definite arbitrary value for impulse strength, expecting the line designer to co-ordinate his insulation with such apparatus values. This was R. N. Conwell's answer to the recommendations of the A.I.E.E. transformer subcommittee at the machinery committee's session. The committee advocated adoption of a table of air-gap spacings corresponding to each of the standard operating voltage ratings for transformers. The values

are shown in the third column of the table herewith. Mr. Conwell felt that the values are based on existing transformer design practice or influenced by questions of expediency in manufacturing.

In his remarks it was pointed out that a gradual increase in line insulation has taken place because of fuller knowledge of lightning and of the possibilities of enhanced service reliability. Co-ordination of insulation makes insulation more effective. In co-ordination the major question is whether the insulation level of the line or of the terminal equipment shall be taken as the base. Mr. Conwell was firmly of the opinion that the line insulation should be taken as the base and equipment insulation graded from it. It was pointed out that adequate data were and are still missing on apparatus bushings and transformer windings and that in their absence the air gap characteristic was apparently to serve as a substitute.

The committee recommendation would in most cases necessitate the installation of air gaps of relatively low breakdown value in vulnerable locations in switchyards, a location which would involve serious interruption to service unless lightning arresters are used. Incidentally, arresters were not used at the Roseland station of the Public Service Electric & Gas Company, according to Mr. Conwell, because they were considered almost as hazardous as an air gap of low flashover characteristics. He did not favor the proposals of the committee because he did not believe they would meet the service requirements without occasioning the construction of a large number of so-called special transformers. The field of practice should be surveyed to ascertain what preferences exist with respect to the base on which co-ordination should rest and what steps should be provided between the insulation levels of the various components of the system. The accompanying two graphs show what these steps were for Roseland. Mr. Conwell also extended the committee's table to show what the proposed ratings would signify in terms of the impulse ratings of standard insulation disks.

Objection was also raised by Philip Sporn of the American Gas & Electric Company to the general principle of basing co-ordination on the operating voltage.

Recommended Transformer Impulse Ratings in Disks and Air Gap Spacings

Rated Circuit Voltage, Kv.	Transformer 60-Cycle Test Voltage, Kv. r.m.s.	Spacing of Air-Gap, Inches	No. of 5½-In. Units Equivalent to Air-Gap Spacing	Practice in Line Design
13.8	28.6	4.25	0.6	....
23	47	6.25	1.0	....
34.5	70	9.25	1.5	....
46	93	12.25	2.1	....
69	139	18.75	3.3	4-8
92	185	25.00	4.6	....
115	231	31.5	5.9	....
138	277	38.25	7.3	8-11
161	323	44.5	8.6	....
196	393	54.5	10.6	....
230	461	64.0	12.5	13-18

Rated 60-cycle voltage bears no specific relation to required insulation for various atmospheric and geographical conditions. He favored the establishment of insulation levels as more significant than arbitrary stipulation in terms of operating voltage levels. It was also pointed out that knowledge of the performance of equipment under transient conditions was not definite enough to permit setting up impulse ratings on which to predicate co-ordination. Co-ordination would be retarded by too precipitate action in this regard.

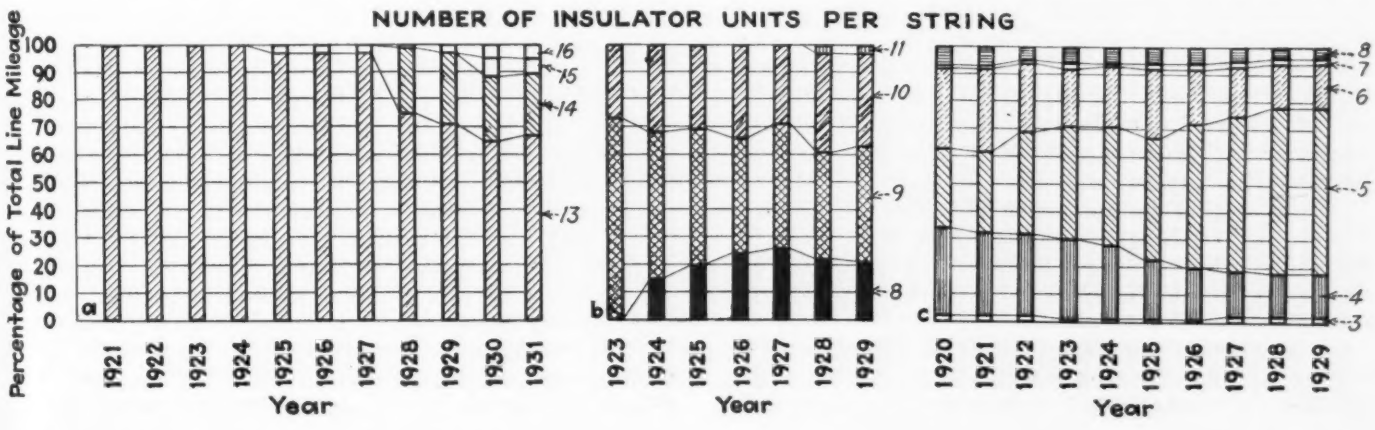
Further comment by Mr. Sporn was to the effect that the committee report merely changed last year's rating in terms of insulator units to a new rating in terms of the air gap. Something more fundamental and less uncertain than the air gap should be used as an impulse index. Experience with air gaps on lines showed they did not always flash over protectively as expected, but that the impulse flashed over occasionally at the bushings of potential transformers and circuit breakers beyond.

F. W. Peek of the General Electric Company was disappointed at seeing the principle of co-ordination levels confused by local operating requirements of service and the variation in atmospheric conditions. He believed that impulse standardization of the transformer need not hamper the progress of co-ordination. Some basis needs to be fixed soon to guide the negotiations between maker and user. Prof. C. F. Harding had previously advocated the use of the sphere gap in place of the needle or rod gap, but Mr. Peek preferred the needle gap because it introduces the element of time lag lacking in the sphere gap.

The manufacturers' representatives adhered to their committee report and the use of the impulse rating of

Fig. 1—Trend of practice as to line insulation

Data from ELECTRICAL WORLD transmission line chart and other sources show tendency toward more units per string at higher voltages and somewhat less units at lower voltages.
(a) Data for 220-kv. lines.
(b) Data for 132-kv. lines.
(c) Data for 66-kv. lines.



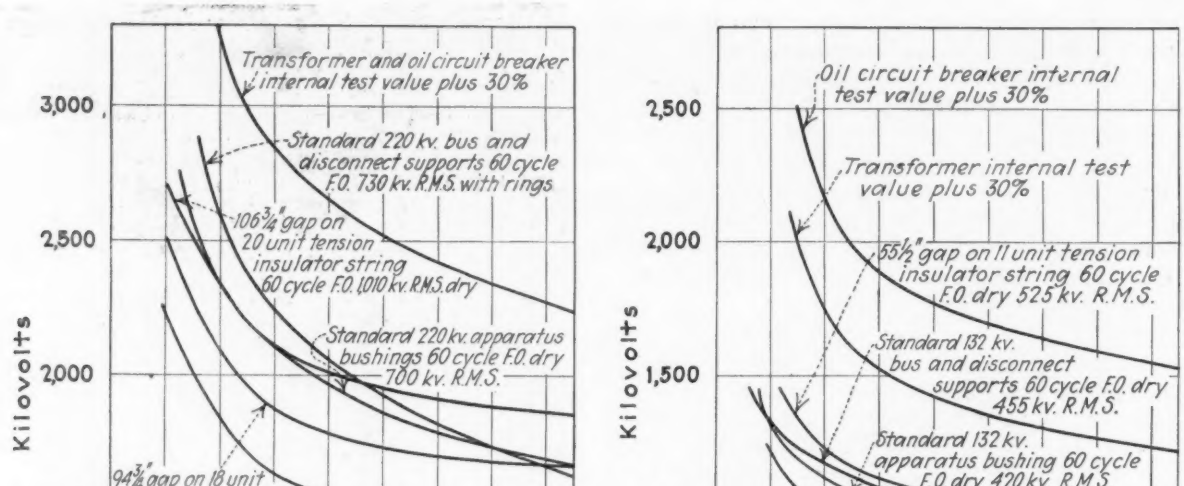

Transformer and oil circuit breaker internal test value plus 30%
Standard 220 kv. bus and disconnect supports 60 cycle F.O. 730 kv. R.M.S. with rings
106¾" gap on 20 unit tension insulator string 60 cycle F.O. 1010 kv. R.M.S. dry
Standard 220 kv. apparatus bushings 60 cycle F.O. dry 700 kv. R.M.S.
94¾" gap on 18 unit insulator string 60 cycle F.O. dry 900 kv. R.M.S. (switching station relief gap)
83¼" gap on 16 unit suspension insulator string standard line insulation 60 cycle F.O. dry 790 kv. R.M.S.
a
Kilovolts
3,000
2,500
2,000
1,500
1,000
0 1 2 3 4 5 6 7 8
Time Lag in Microseconds
Oil circuit breaker internal test value plus 30%
Transformer internal test value plus 30%
55½" gap on 11 unit tension insulator string 60 cycle F.O. dry 525 kv. R.M.S.
Standard 132 kv. bus and disconnect supports 60 cycle F.O. dry 455 kv. R.M.S.
Standard 132 kv. apparatus bushing 60 cycle F.O. dry 420 kv. R.M.S.
44" gap on 9 unit suspension insulator string 60 cycle F.O. dry 420 kv. R.M.S.
b Standard 132 kv. arrester
Kilovolts
2,500
2,000
1,500
1,000
500
0 1 2 3 4 5 6 7 8
Time Lag in Microseconds

Fig. 2—Insulation grading at Roseland station

(a) 220-kv. side. (b) 132-kv. side.
Time lag curves for various components of terminal apparatus show margin available for co-ordinated grading.

the transformer as a bench-mark from which to grade line and terminal apparatus insulation. Expression of the rating in terms of the air gap spacing did not necessarily mean that the air gap would have to be used in conjunction with the transformer, although this might prove desirable for the lower voltages. V. M. Montsinger, member of the committee, felt that the recommended minimum was high enough in impulse rating to avoid the necessity of special designs to meet system needs as the exposures and service requirements dictate. The operating men appeared to fear, however, that the manufacturers' proposals would require at least three grades of impulse rating for each operating voltage rating in order to meet the range of field requirements.

Comment on P. L. Bellaschi's paper describing the characteristics of surge generators for transformer testing hailed it generally as the first comprehensive report on their design and behavior in conjunction with impulse test loads.

Dampers only remedy for vibration

The importance which conductor vibration of all sorts is assuming in the minds of transmission engineers can be sensed from the comment of F. E. Andrews of the Public Service Company of Illinois that, as far as the Chicago area is concerned, vibration is a greater problem than lightning. After years of immunity lines have suddenly started to whip so violently that it has become necessary at times to take them out of servce for several hours. The papers and the discussion together at Friday's session indicate that the phenomenon is an obscure one, although there was general acceptance of the theory that the slow vibration of ice-coated conductors can be attributed to a demonstrable aerodynamic instability.

In support of this theory, J. P. DenHartog set into violent vibration by means of an ordinary fan a block of wood of semi-circular cross-section supported at its ends between two pairs of vertical springs. The air was directed at right angles to the flat vertical face. The slightest dissymmetry of the conductor as glaze begins to form on it gives a chance for the wind to exert a pressure in the vertical direction. As soon as the least displacement occurs the subsequent result is that the wind always acts to displace the conductor further in the direction in which it is moving, thus accelerating and enhancing the vibration.

E. W. Dillard of the New England Power Association and C. W. Bassinger of the Massachusetts Institute of Technology brought the matter of voltage and corona into the discussion along with the aerodynamic hypothesis of Mr. DenHartog. The former cited some of the phenomena on the Fifteen-Mile Falls line to support the suggestion that the critical disruptive voltage for corona formation under prevailing atmospheric conditions must be related properly to the conductor diameter in order to have vibration result. He advised that it would be well to watch for vibration under precipitation conditions when wind velocity is low and the line voltage at the spot is close to the critical corona-forming value. That corona and voltage do have a pronounced influence was emphasized in the discussion contributed by Mr. Bassinger. He reported on the results of experiments with wires energized at high voltage and spun in a glass-insulating frame by means of a torque motor. A d.c. commutator-type watt-hour meter was calibrated for torque and from its input it was found that the torque required of it to rotate the wires at a given rotational speed about a vertical axis was dependent on the voltage impressed on the wires.

J. P. Jollyman, according to E. F. Maryatt, is conducting experiments in vibration on the lines of the Pacific Gas & Electric Company, the results of which

will be reported before long. As for a remedy for the slow-period type of vibration, sometimes called "dancing" or "whipping," there appears to be none except to melt off the sleet. Dampers are not effective, as in the case of the much smaller amplitude vibration obtained by bare conductors in light winds and without glaze. The velocity of motion in the former case is too low to bring the inertia of the dampers into effective play. Dancing appears to occur only with stranded conductors, while the rapid nodal vibration may occur with smooth or stranded conductors.

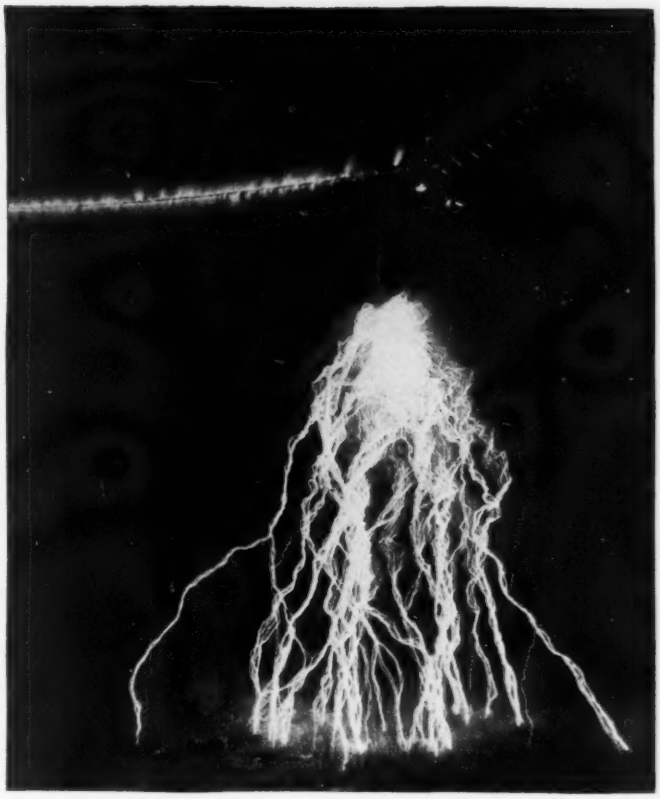
A. E. Davison of the Hydro-Electric Power Commission in his paper had concluded that conductors with a triangular cross-section were most nearly immune to vibration. There are practical objections, however, to the fabrication and use of conductors that depart widely from circular cross-section. Dampers are apparently quite satisfactory in contending with the high-frequency type of oscillation. J. A. Johnson of the Niagara Hudson system suggested further trial with a spring and friction absorption device at dead ends. He mentioned one severe case of "galloping" or dancing on a partially erected line that was not energized. It happened in midsummer and with a mild breeze. This episode went unrefuted by those who offered sleet and corona as explanation of the long-period, wide-amplitude vibrations.

Extensive stress-strain tests of various transmission line conductors conducted over a period of several years were reported by G. W. Stickley of the Aluminum Research Laboratories. The conclusions are that cables which have not previously been stressed are not elastic throughout the range of stress to which they ordinarily are subjected when used in transmission lines. The proportional limit is raised by application of stress beyond this point. Application of stress also increases its actual modulus of elasticity. But since winding on a reel again reduces the modulus it is necessary to do the prestretching in the field incidental to the stringing of the conductors. T. J. Little of the Anaconda company in his discussion concurred in this advice.

Pilot protection regains favor

Greater ability to discriminate between faults and the mere power surges which often follow them was claimed for a new high-speed reactance relay at the protective devices session. To this extent relaying makes further progress in meeting the increasingly complex task of system protection. The operating men, however, seem more than ever disposed to feel that the virtues of pilot-wire protection have been in part at least overlooked. For more than the relatively short distances for which leased or owned pilot circuits are economical and feasible there is now available a means of using carrier-coupling condensers for actuation of the potential devices and the view into the future envisages the use of carrier currents as the equivalent of the physical pilot circuit.

G. W. Gerell of St. Louis outlined in considerable detail the bases on which protection was adopted for the Osage-Cahokia open loop. In commenting on the performance of the distance, ground and back-up protection he questioned the efficacy of high-speed relays. While they had cleared many faults in a wholly satisfactory manner, there were several cases of trouble which no theory explained to every one's satisfaction. Comment on this statement by E. H. Banker of the General Electric Company welcomed it as disclosing the factors from the field of practice which design has overlooked. Evidently the desired relay must take into account more than merely the voltage, current and phase angle at the point where it is installed. This attempt to devise an intricate scheme which will actuate devices at one point to function in correlation with similar devices at several other points is leading, however, to complexity. The way out may be actually to transmit the fault indices by carrier superposition on the power currents in the line conductors. Philip Sporn of the American Gas & Electric Company also identified the pilot system or its equivalent as the only universal and simple protective system.



Spillover of 1,000,000 volts at 70,000 cycles
One of the views taken at the Ohio Insulator Company's spectacular demonstration at Barberton

Two other points stood out in this protective devices session. Several members deplored the fact that management will spend up to two years in building a line, but will not grant the protection engineers even a day to stage short-circuit tests and prove the efficacy of the relay installation. The automatic oscillograph was also commended by several as a valuable aid to the relay engineer in accounting for the otherwise unexplained transients and the response of the relays to them.

E. E. George of Chattanooga emphasized the advantage of connecting current transformers in delta for use with distance type relays to minimize the tendency to trip on mere power surges. H. C. Van R. Warrington, however, pointed out that the relay described in his paper accomplished the same purpose. E. P. Peck of Buffalo said it was loose language to talk of one-phase shorts or

faults, two-phase faults and three-phase faults. A two-phase fault means one thing to a protection engineer and a different thing to an engineer engaged in inductive co-ordination. It would be far better for the relay man to talk of one-conductor faults, two-conductor faults, etc., although "three-phase fault" might not be a wholly objectionable term.

The balance of the discussion at this session was on the new schemes of using bushing potential devices and carrier-current coupling capacitors to supply the potential for relays. One of these devices is reported practically in full elsewhere in this issue. There was also discussion of the new boric acid fuse announced by the Westinghouse company. The principal question raised by operating men was as to the behavior of the wholly inclosed fuse under fault currents greatly in excess of its rating. The authors of the paper claimed an unlimited interrupting ability and anticipate no bursting of the container, because the higher the current the shorter the time of interruption and the less the explosive pressure tends to go to high values.

Education and professional problems

In addition to the sessions which have been reported in considerable detail there were papers on education, electrochemistry and electrometallurgy, communication, automatic stations and telemetering. Dean Lovell of the University of Michigan made a plea in the education symposium for a thorough analysis of the technical content of electrical courses to determine what shall be set up as the common denominator fundamentals of electrical technology in all its ramifications. The proposal received general support in the discussion. One suggestion, by A. E. Knowlton, urged that the horizontal functions of generation, propagation, insulation, protection and utilization be allowed to shape the courses instead of the present specialization in power, telephone, radio and transportation as reflected by the business subdivisions of the industry as a whole. Prof. R. E. Doherty of Yale in his paper drew the line between engineering and engineering management, ending with the suggestion that educational policy recognize a sub-professional group and three distinct professional groups, viz., engineering, engineering management and general management. Thus industry would be encouraged to reward technical engineering leadership more appropriately.

As a part of the session on communication, devoted in part to the application of wire and wave communication to air service, there was an elaborate demonstration of the new vertically cut sound records. This was an adjunct to a paper by H. A. Frederick and H. C. Harrison of Bell Telephone Laboratories, Inc. The superb reproduction of voice and music convinced the audience that disk records have benefited enormously by the application to them of the multitude of lessons learned during the intensive period of radio development.

An abstract of the paper by A. J. Johnston describing a new telemeter appeared in last week's issue. In discussing it E. J. Rutan of the New York Edison Company pointed out the advantages of the current type of telemetering systems of which this is an example. One feature is that it makes possible separate purchase and selection of transmission and receiving equipment of different makes. This is desirable, in his opinion, because at the present stage of development some makes of recording meters are inferior to the transmission equipment of the same make. J. H. Oliver of the General Electric Company had a paper setting up the operating requirements for two-wire supervisory systems for distances of 2 miles and upward. Comment by Mr. Peterson pointed out a limitation of systems of supervisory control in that synchronizing of a system from a remote point is a necessary function. It was his opinion that this task might best be left to automatic synchronizing equipment rather than incorporated in the supervisory system. M. E. Reagan contributed a general description of the new Westinghouse polaricode system in both two-wire and four-wire types.

In view of the wide variety of telemetering and supervisory systems available and the difficulty in comparing their scope and characteristics, a comprehensive report was presented by a joint committee of the committees on automatic stations and on instruments and measurements.

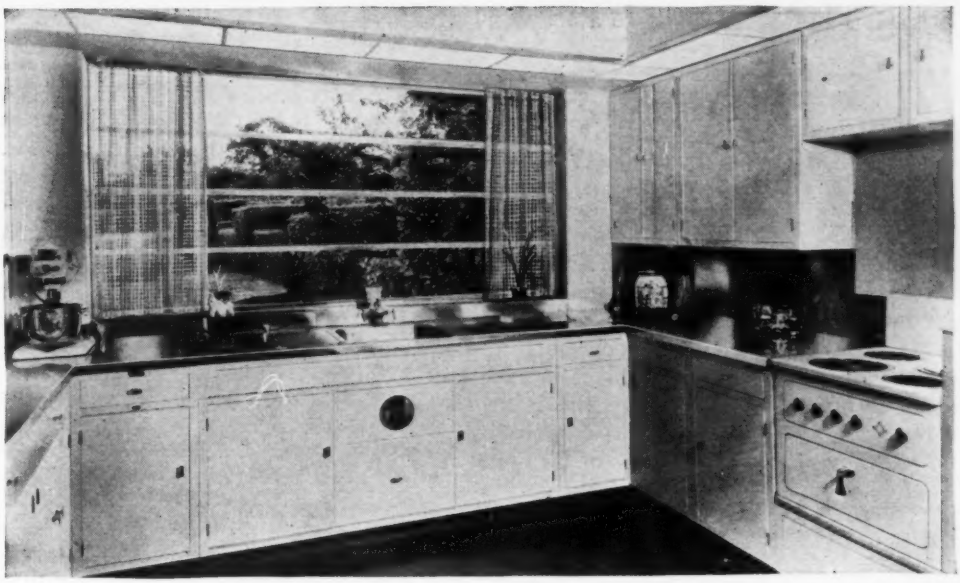
This exhaustive report was commended by Paul MacGahan as a great help to operators in deciding upon the system to adopt for the specific operating task. Thirty-three different telemeter systems are tabulated in the report under 23 topics in the four main divisions of (1) character of indications provided, (2) performance, (3) characteristics affecting line transmission, (4) interference and protection features. A similar elaborate chart embraces fifteen different supervisory schemes analyzed under the same general aspects.

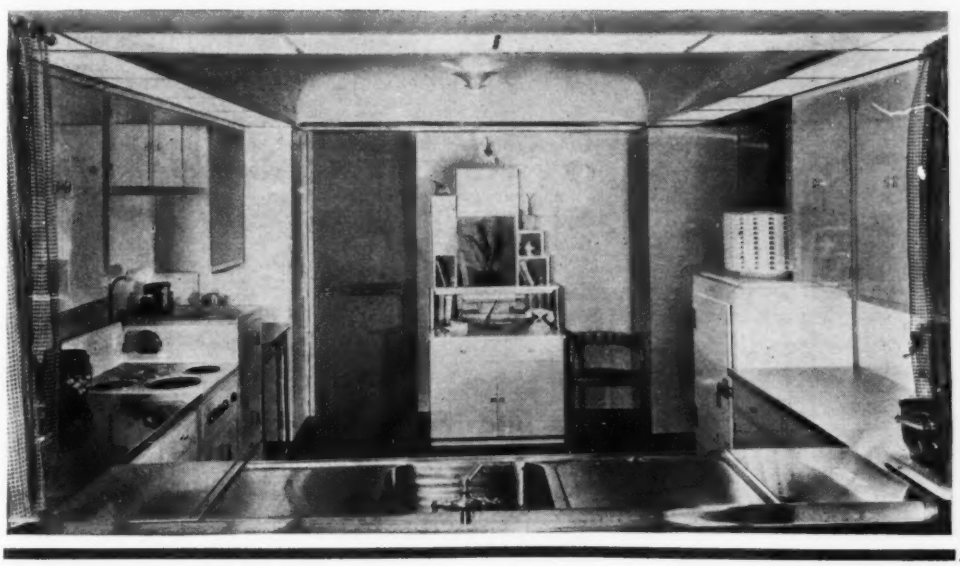
Adequate wiring stressed

An active discussion on the necessity for more adequate wiring of buildings was stimulated by a paper presented by G. H. Stickney and Walter Sturrock. It was pointed out that little engineering attention had been paid to wiring or wiring devices and that this field presented a great opportunity for engineers. Philip Sporn said that much misunderstanding of the code existed and that the development of new methods and practices in wiring had been rapid and very promising in cost reduction. Professors Dates and Caldwell said much progress had been made in advancing the codes for lighting standards in schools and showed that the upper limits of lighting were yet far in the future. L. W. W. Morrow said that adequate wiring and lighting had a humanitarian, a business and an engineering aspect. He pointed out that each floor of a large building represented a lighting load alone of some 1,200 kw., yet engineers in general consider wiring and lighting too "low brow" to merit their attention. He said there was a big opportunity to focus the highest engineering talent on wiring and wiring devices, as had been the case in the parallel development of equipment used in communication engineering.

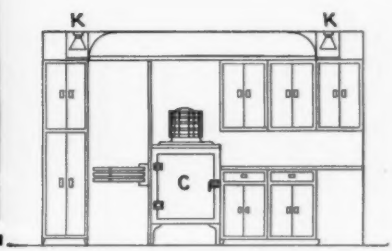
The versatility of the induction motor was stressed by E. W. Henderson, and in discussing the paper P. L. Alger said promising progress had been made to supply variable frequency to induction motors from a fixed frequency supply by means of vacuum tubes. The mathematical solution of the problem of dynamic braking of synchronous motors was presented by E. E. Kilbourne and J. A. Terry and another mathematical analysis of stray current effects in electric transportation was presented by J. F. Riordan.

Co-ordinated Units Modernize the All-Electric Kitchen

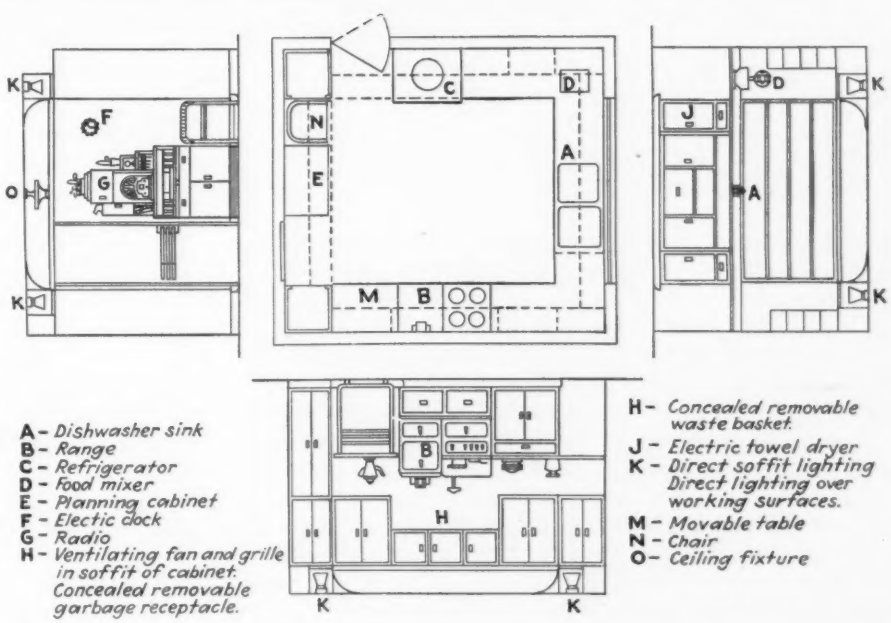




Two views of the General Electric Kitchen Institute display in Chicago and a sample layout



The General Electric Kitchen Institute is a new and promising departure in home electrification. A display kitchen such as shown is located in Chicago and upon this display is based a home service plan. Any one, upon application, can get a splendid architectural layout for his individual kitchen. The one illustrated contains the following equipment: Dishwasher sink, range, refrigerator, gem mixer, planning desk, clock, ventilating fan and grille, movable table, chair, ceiling fixture, panel lighting, timer for range, chrome bars on doors and cabinets. Allegheny metal is used for all working space and splashboards and porcelain enamel cabinets add to the attractiveness of the kitchen.



A – *Dishwasher sink*
B – *Range*
C – *Refrigerator*
D – *Food mixer*
E – *Planning cabinet*
F – *Electic clock*
G – *Radio*
H – *Ventilating fan and grille in soffit of cabinet. Concealed removable garbage receptacle.*

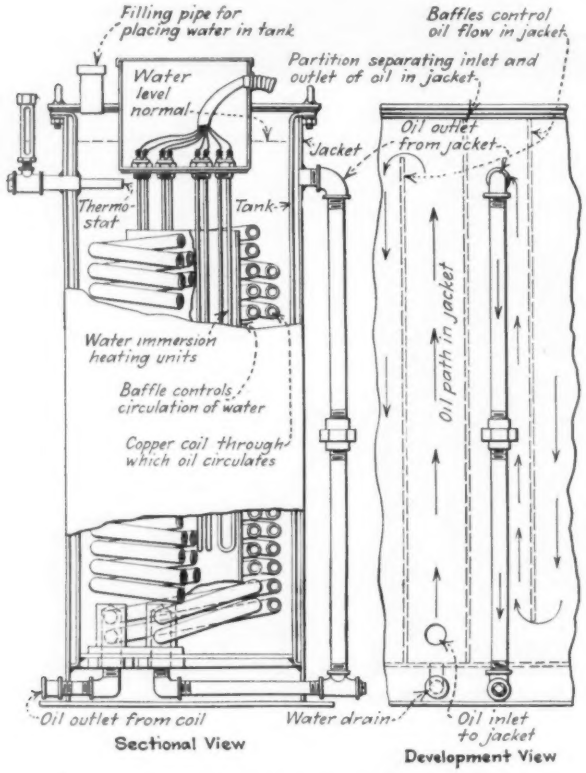
H – *Concealed removable waste basket.*
J – *Electric towel dryer*
K – *Direct soffit lighting Direct lighting over working surfaces.*
M – *Movable table*
N – *Chair*
O – *Ceiling fixture*

Overheating of Oil Avoided When Purifying

By F. E. FINLAYSON
Specialty Department, General Electric Company

When cable, transformer or circuit breaker oil has to be purified by passing it through a filter or centrifuge the operation can be greatly expedited by preheating the oil to reduce its viscosity. All operators do not use the same temperature, although it is commonly in the neighborhood of 50 deg. C. Temperatures in excess of 120 deg. C. will injure the oil, although the injury is dependent on time of exposure as well as temperature.

Even though the whole body of oil is not raised above



Features of heater for use with oil purifiers

Oil enters the outer casing and circulates up and down the height of the tank through a system of baffles, going completely around the tank before it enters the copper coil, where it is heated by the surrounding water in which the immersion units are submerged. The outer jacket of cold oil minimizes the heat loss.

this temperature, the film which comes in contact with heating units may be heated above what is considered a safe temperature if units with a high heat dissipation per unit of contact surface are used. However, the extreme brevity of contact limits the injury to the oil, although many uses of oil, such as in high-voltage transformers and oil-filled cables, cannot tolerate any injury.

A manufacturer of oil-filled cable, while experimenting with a purifier equipped with oil-immersion heaters, found that the comparative ohmic resistance of the purified oil fell off materially after treatment. An investigation proved this change was caused by the oil coming in contact with oil-immersion heaters having a high watt-density per square inch of contact surface.

To prevent such trouble a heater has been des: which is inherently proof against causing injury to the oil. It embodies the indirect methods of heating, utilizing water as the heat transfer medium because, at atmospheric pressure, it cannot be heated above 100 deg. C. Due to the large area of contact between the oil in the copper cubes and the water outside there is no excessive temperature gradient. The actual watts density of the heated surface in contact with the oil is less than 6 watts per square inch, compared with 40-50 watts in some immersion heaters. Even if the oil flow stops the final temperature cannot exceed that of the water. The heater can be made automatic by installing thermostats in the water and outgoing oil.

Tests made on a 60-kw. low-density heater constructed as shown prove that the principle is right and that the

Oil Flow in Gallons per Minute	Incoming Oil Temperature, Deg. C.	Outgoing Oil Temperature, Deg. C.	Oil Temperature Rise, Deg. C.	Water Temperature, Deg. C.	ITO Efficiency, Per Cent
30	23.8	41.8	18	92	97½
20.2	23.8	50	26.2	98	96

heater is highly efficient. The results shown in the accompanying table were obtained during a test run using transformer oil having a specific gravity of 0.875 at 50 deg. C. and a specific heat of about 0.47.

▼

Curing Rubber Products by Electric Heat

In the manufacture of rubber products one of the major operations is to cure the rubber at a temperature around 310 deg. F. while under a very high pressure. One method of doing this is to place the rubber in steel molds between platens of hydraulically operated presses, heated by steam at about 65 lb. pressure.

To increase the capacity of his plant a manufacturer of rubber specialties was confronted with the necessity of either overhauling his steam plant or installing new apparatus. As the result of a preliminary trial, it is reported by Arnold Spillman of the promotional analysis section, Philadelphia Electric Company, the manufacturer equipped all his presses with automatically controlled electric heaters. This brought a heating load of 40 kw. to be supplied by the power company.

After a year's operation the following have been found to be some of the most noteworthy advantages of electric heat over steam heat for the platens.

1. The over-all cost of the finished material is lower.
2. The material is more uniformly cured.
3. Working conditions are better. Overheating of the workrooms, humidity and damp floors have been eliminated.
4. A more constant temperature control has been made possible.
5. Instead of having some one come early in the morning to raise steam a clock automatically throws on the power at the proper time. It also disconnects the heaters at the end of the working day.
6. Individual presses may be worked overtime.
7. Boiler trouble has been eliminated.
8. The change to electric platens has effected a saving in insurance rates and in space.

Operating Problems That Need Solution

By A. E. SILVER*
Electrical Engineer Electric Bond & Share Company

ANY growing industry and, in particular, one making the remarkable developmental strides into new ground that ours has done, must from time to time reappraise and realign its practices and trends. It is opportune to take stock of our more urgent problems brought by this readjustment period.

During the past two decades our engineering departments have been hard pressed with demands for designing and constructing new facilities. They can profitably employ this lull in new construction for a hindsight on their own work and to assist the operating departments by a thorough review of the operation of our power systems to see wherein costs may be reduced and methods otherwise improved.

There are obstacles in the path, but many already have been cleared away. Some of those remaining are: (a) A more complete recovery of the total energy of the prime fuel; (b) the better mutual adjustment of station capacity and the characteristics of loads; (c) radical improvement in the possibilities for insulation and in the switching and control of electrical loads; (d) the development of unified, simplified and adequate distribution practices, and (e) corresponding advances in utilization equipment and apparatus on customers' premises.

Many, if not all, of these obstacles have been charted before. However, under changed economic conditions their relative importance may have changed and a re-evaluation is in order. We are confronted with the necessity of effecting greater economies in maintaining and extending service to customers without unwarranted reduction in the quality of service.

Immediate economies in operation and maintenance

The first item encountered in operation is that of current fixed charges—interest, taxes, depreciation and obsolescence. This strikes home with a new significance under the conviction that nothing can be done to reduce it; it is a dead load. The only relief is through building back and increasing the loads on this idle plant capacity, making it work harder and more hours. We should be alert to unearth new angles for analyzing system performance in a search for unobserved leaks in efficiency and opportunities for economies.

We can reanalyze system energy losses with a view to working out a more efficient operating routine for circuits and equipment, including transformer, synchronous condensers, frequency changers and rotary converters.

Under the urge to economize, a frequently heard demand is that standards of service be lowered; that less vigorous methods for repairing and restoring service after faults be adopted. This step requires deliberate discrimination or impediments will be thrown directly in the path of load-building efforts.

When considering greater tolerances for service standards we must segregate those service qualities which might be termed as belonging to the luxury class from those similarly classed as necessities. Service qualities that mean dependability and profit to the user are necessities. Economies can, and should, be realized by allowing greater tolerance in those qualities of service which do not substantially affect its dependability and earning power. The farmer, for instance, is not injured by momentary interruptions or occasional voltage dips, but in the face of prolonged interruptions he will not equip for electric milking and other work where scheduled operations are essential to profit.

On systems well kept up during the recent prosperous period considerable postponement of maintenance work may be allowed. Selections must be made intelligently to avoid interfering with service and safety. Where a systematically administered maintenance procedure has been built up a lengthening of schedule periods between inspections and overhaulings will be permissible for many items.

We can survey our systems for arrangements, equipment or gadgets installed from time to time as safeguards against this or that kind of operating trouble. A check-up against today's conditions may show that some are no longer worth while or are causing more trouble than they can be credited with avoiding. Take, for example, sectionalizing switches and cut-outs, which many companies have been prone to distribute freely over their lines. Frequently it will be found that eliminations can be made with no sacrifice to service and with a net saving in maintenance costs.

We can be more frugal in our practice of retiring equipment from active service. Obsolescence can well play a smaller part in justifying removals and replacements. The next several years should find equipment giving a substantially longer span of service before terming its replacement justified.

Published figures show that current theft has increased alarmingly in the past few months, caused apparently by hard times. While it is a difficult evil to control, its seriousness justifies redoubled efforts. One effective aid is the outdoor meter, located to minimize opportunity for concealed tapping. It is a further deterrent as it forces the current thief to do his work in the open under the possible scrutiny of his neighbors and others.

More efficient use of generating facilities

Good progress is being made in the development of the outdoor type of meter and meter installation, but much yet needs to be done in the simplifying and unifying of practice. The engineers of the power companies and

*Abstract of paper presented at Engineering National Section session, N.E.L.A. convention at Atlantic City.

the manufacturers should co-operate in developing simple, adequate and low-priced service installations incorporating the advantages of meter interchangeability.

Attention in matters of power costs generally has been focused on production cost, and this in the newest plants, the ones favored with the highest load factors. I question if this emphasis does not give the men in charge of the industry false ideas regarding the cost of power. It certainly seems to give our customers false ideas.

Suppose we should endeavor to compare the actual costs of the kilowatt and kilowatt-hour sold in the years from, say, 1928 to 1931, with production costs predicted for the new power plants then completed. I venture that not 10 per cent of the men responsible for designing these newer power stations would have these figures available. Such a determination, sincerely made, would be of great value in furthering the maximum utilization of the plants now existing and also would constructively influence plans for future extensions.

At this time the so-called plant efficiency or plant betterment activities of engineers should be redoubled. While a considerable number of operating and supervising companies maintain a staff of this character, even here the work is not in all cases thoroughly organized and followed up.

In the case of steam and Diesel generating stations fuel expense may be reduced by improving plant efficiency or by a change in character or type of fuel, sometimes through co-operation with the purchasing agent in the choice and purchase of fuels.

Even today, with our reduced loads, it is probably the case on many of the power systems that any available kilowatt-hour which is not secured from the water at the hydro plants must be made up by a kilowatt-hour generated in the steam plants. It is probably true, also, that on a majority of systems of this type in this country the management, although closely following the over-all operating economies of the steam plants, is not informed of the quantity of energy being wasted by avoidable inefficiencies in the use of the water.

It may be of interest that only very recently exceptional cases have been discovered of plants turning out only one-quarter to one-half the energy they should have been producing.

It is my belief that a majority of the hydro-electric systems in this country today are not producing within 5 to 15 per cent of the kilowatt-hours which they could be made to produce by improved methods of operation, proper dispatching and loading of the units and some relatively small expenditures for minor changes and maintenance.

The larger system problem is effectively to co-ordinate all the hydro units with all the steam units so as to produce the total power and energy requirements at the minimum cost. To accomplish this each station must be made subservient to the over-all system result. Pride of the individual station superintendent naturally strives for a good performance showing. In his thorough co-operation lies one of the leading opportunities for accomplishment in system load dispatching.

I believe that today comparatively few interconnections are yielding all the benefits they reasonably should. Only infrequently are they being treated as a consolidated system in determining the operating procedure.

To foster maximum use and benefit of interconnections operators and engineers must be allowed all practical latitude for seeking out diversities and differentials and developing methods of co-ordinated operation to take advantage of these. Benefits should be pooled and the incentive created to make this pool a maximum, then divide the pool equitably among the participants. With interconnections developed and operated from this approach, simple contractual and accounting relations readily will be found to provide all the needed safeguards. Automatic load and frequency control devices, intelligently applied, are a valuable aid in co-ordinated system operation.

Engineering in protecting and building loads

Diesel engine designers have been alert to their opportunities—much more so, I believe, than the engineers of our industry generally realize. The last few years especially have brought a marked improvement in materials and design, with greater reliability in operation, higher efficiency, higher speeds and lighter weights. Approximately there has been a 50 per cent reduction in price per horsepower, reductions in weight and volume per horsepower reaching 90 per cent and large savings in maintenance cost and operating attention. All this has meant the installation of a large number of Diesel engines for small and moderate-sized industrial work and for municipal plants, the engine manufacturers selling their equipment on easy payment terms.

In meeting this competition a new order of analysis and comparison must be applied. In each important case of competition there must be full information developed as to what the installation, operating costs and reliabliity of service will be for Diesel engines in comparison with purchased central station power.

If it is found that in some situations the Diesel engine shows economies superior to those from conventional power system service, then the ingenuity of our engineers should be called upon to apply this advantage in some manner as a central-station function. Service from the Diesel engine as a central-station adjunct should have advantages over completely isolated service.

Fully as keen competition is being pressed in some of the larger energy-consuming industries by the availability of low-cost high-pressure steam equipment that may be used to supply process steam for industrial use, with electrical energy as a by-product; in addition, some of these industries produce by-product heat or by-product fuel. Such competition requires a careful analysis of the industrial operations, comparing central-station supply with an isolated plant, determining the most economical method for the industrial of serving the combined requirements for electrical energy and process steam or, on the other hand, of utilizing the by-product heat or fuel.

In meeting such competition the power salesman must have competent engineering help, particularly as the industrial often retains excellent consulting engineering talent.

While load building is primarily a commercial and rate function, nevertheless engineering assistance is needed. The engineers must study the principles of

reducing the cost of service so necessary to accelerate load building. An immediate and very real barrier to load building is excessively elaborate and expensive inside wiring practices. That very substantial advances, indeed, only await the necessary initiative for their development and application is amply justified by present accumulated knowledge and experience. In the interest of guiding the home owner to lower wiring costs, our engineers must enlist in the practical working out of simplified and safe wiring methods and in a proper liberalization of the National Electrical Code to sanction their use.

There are many potentially promising fields for load building which are awaiting accomplishments by the engineers as a necessary part in their development. Among these are:

Farm loads requiring further progress in low cost lines and equipment.

Domestic range and water heating loads requiring lower cost house wiring.

Industrial applications and, in particular, miscellaneous appliances which bring service conveniently, accurately and efficiently to the spot needed.

Even with an adverse cost differential under conditions of normal operation, distinct economy is being found in this period of stress by shutting down oversized industrial facilities.

Space heating and air conditioning. With regard to the first of these, we should not be discouraged by the slow progress to date. It merely demonstrates the need for a different approach. The development of heat storage and application of knowledge already gained in heat conservation (meditate the increase in heat efficiency of domestic cooking in a generation) may be the gateways to this new approach. Air conditioning or space heating by the refrigeration cycle, or both, may well open the door.

Each and all of these applications invite engineering co-operation in the working out of satisfactory utilization practices and also point very surely to a steadily growing demand on our detail distribution facilities. Take, as a yardstick, approximate figures for the average American home located in the latitude of New York City. Present consumption with average appliances is 500 kw.-hr. per year; with range and water heater added 6,500 kw.-hr.; with the further addition of air conditioning, 9,300 kw.-hr., and, ultimately, with space heating, perhaps 50,000 kw.-hr. per year. Present generally prevailing distribution practices will break down from lack of capacity, lack of dependability and excessive cost at various stages along this road.

Capacity for increased service at small increment cost

There will be a period of a few years while the design and development of major generation and transmission facilities may wisely rest until the trend of future needs becomes evident. The present emphasis falls on the necessity of thoughtful economy in the task of rebuilding and expanding our loads. A premium is placed upon finding constructive modifications of present facilities to give more service at small increment capacity cost. The field for this is broad, although distribution is the most fertile. Here development engineering has lagged far behind that concerned with the major facilities of generation and transmission.

There are several directions of attack, but perhaps the first should be toward increasing the dependability of service from present facilities. Increased dependability is an equivalent of increased capacity, for it reduces necessary reserve. A few such items are:

The burn-off of a distribution circuit conductor or the thermal destruction of an insulator, following a spill-over, with service interrupted pending repairs, is far too often taken as a matter of course. The advance in relaying of the last decade, gained through efforts to advance the service dependability of transmission circuits, points the way to improvements in distribution circuit relaying that will go very far in limiting fault damage to the point of assurance that the circuit will immediately return to service.

Carrying further the idea of quick disconnection and prompt return to service is fast automatic reclosing of feeder circuit breakers. Automatic reclosing switching and relaying equipment, now available, is capable of removing a fault within such a few cycles that the effect on lighting and induction motor loads is practically negligible. Weigh carefully the significance of this, with more than 80 per cent of circuit trip-outs due to instantly disappearing causes.

Lightning research, particularly that conducted in the field with natural lightning, although so far directed primarily at circuits of transmission voltage, is bringing a valuable insight into the control of lightning on distribution circuits. Past tendencies to increase line insulation as a means of cutting down distribution circuit interruptions and damage have been shown clearly in error. Effort may better be directed, with a reasonable degree of insulation, to providing for the lightning surge to spill freely without damage at its point of inception on the circuit with, at most, only momentary interruption to service.

This knowledge from lightning research, quite similarly, can be applied to control overvoltages and equipment damage at line terminals. The better-proportioned and inherently more rugged insulation that is resulting is a gain toward self-protecting or lightning-proof equipment. All this leads to simplified lightning protection and increased service dependability at substations.

Where circuit dependability is good, simplification and ecoonmy can be gained by the consolidation of power and lighting circuits, also by avoiding the carrying of single-phase primary laterals back to substations for individual switching. The common neutral for primary and secondary circuits offers a substantial gain of this kind.

More extensive joint use of poles by power and communication companies, besides offering substantial economies, will profit in increased public convenience and improved public relations.

Many problems of distribution planning are often added to the duties of the construction and maintenance staffs. I believe this is false economy, for these problems are sufficiently basic and complex to require systematic, concentrated engineering development.

Alertness and ingenuity will discover more frequent opportunities for shifting idle or partially loaded equipment, in lieu of purchasing new, to locations where increased capacity is required. For example, a careful check-up of the loading of distribution transformers may unexpectedly show frequent cases of needless overcapacity.

With small adjustments or modifications, many hydrogenerating units may be arranged for quick starting and synchronizing, automatically if desired, or for running as condensers with the gates closed, ready for quick emergency pick-up.

When additional power output is required from existing steam plants, particularly for carrying peak loads,

the engineer can frequently work out economic capacity increases for relatively small expenditures. These might comprise a moderate increase in steam pressure, use of a fuel such as oil or gas, in addition to coal, to increase boiler output; change-over of boilers having low load factor duty from coal to oil or gas fuel to obtain higher peaking capacity; reduction in steam extraction from the higher pressure bleed points of turbines, to permit greater maximum outputs; more strenuous repair work to avoid long boiler or turbine outage for maintenance.

Simplified design and lower costs for system extensions

Among the presently recognized items that can contribute to simplifications and economies are:

Reduction in the number of system voltage levels with the elimination of intermediate transformations; the lower distribution voltages may well give way to higher distribution voltages, especially so in extensions to new areas. These are items of large importance in both investment and operating economies.

In the field of service to the farm there is room for large gains. A systematic planning procedure is timely in predicting the needs and locating and proportioning the facilities for building up service in a given area. I have in mind one operating company that faced the farm service situation squarely just a few years ago. It was treated as a major engineering problem. Thorough system planning methods were applied. Although in thin territory, an outstandingly low investment per customer has been achieved for facilities planned to provide service to the entire area.

For serving areas of heavy load density the secondary network system is demonstrating very real merit in investment, operating cost and in quality and dependability of service. With the simplifications and adaptations that are either under way or that reasonably may be expected, the secondary network may well be extended to overhead duty.

For underground areas cable buried directly in the ground, long a European practice, is proving to be applicable for frequent use even under American conditions. It affords substantial savings over conventional conduit construction where few cables are required.

Complicated circuit diagrams and switching and control arrangements, providing much flexibility and multiplicity of safeguards, have been the trend in station and substation practice. Simplification of switching equipment and circuit arrangements will be beneficial.

In generating station design care must be taken that in predicting the economies of a new development the use factor assumed for equipment be not too high. It may be found more economical to provide low cost peaking capacity of only moderate efficiency than, as has been the custom in this country, to make the new plant of an efficiency higher than the last one. Investment in structures may be reduced by such expedients as laying out equipment to reduce the volume of building and reduce the loads supported by the steel work, using lower cost wall and roof materials, placing in the open certain equipment that has heretofore been housed; using large, and therefore a small number of boiler units, not infrequently one to a turbine, and using large turbine units, with due regard to economical working within the load curve.

The controlling economies of any industry are continually in a state of flux, and particularly so under conditions such as now confront us. In the present period investment carrying charges, especially interest and taxes, are increasing; labor costs are decreasing. The engineer must determine the proper balance and strive to maintain this balance in step with the average change in the factors entering therein. For the immediate future this balance requires that investment costs be lowered even though labor operating expense is increased.

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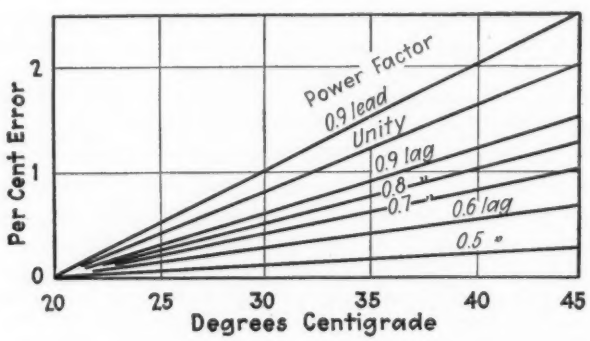
Correcting for Temperature Errors of Watt-Hour Meters

By G. W. STUBBINGS
London, England

Although the effect of temperature variation on the accuracy of an induction type watt-hour meter is relatively small, and very small with modern compensated meters, it is often desirable to be able to estimate the change in the rate of registration of a meter which is operating at a different temperature from that at which it was calibrated. The problem of temperature correction is complicated by the fact that the change in accuracy depends not only on the temperature but also on the power factor of the circuit metered. The change in accuracy of an induction meter is generally less than 0.1 per cent per degree C. temperature change, with a circuit power factor of unity, but with a power factor of 0.5 lagging the effect of temperature becomes very small or even negative in some cases. The induction meter thus really has two temperature coefficients, the one applying to the effect of temperature change on the unity power factor calibration of the meter, and the other applying to a change in lagging produced by a variation of temperature.

The actual causes of the effect of temperature change on meter accuracy fall under two heads (see ELECTRICAL WORLD, December 20, 1930, page 1127). The reduction of the flux of the permanent brake magnet with a rise of temperature tends to cause over-registration. The



Temperature error for any power factor

The effect of a given temperature change can be calculated for any circuit power factor provided that these effects be known at two power factors, say at unity and 0.5. In the accompanying diagram the graphs connecting meter error and temperature for power factors of unity and 0.5 are typical of the uncompensated meter. The difference between the two temperature errors for a rise of 25 deg. in this case is about 1.7 per cent. Dividing this figure by the tangent of 60 deg., we find that the change in the phase of the voltage flux for a rise in temperature of 25 deg. is about 0.1 radian. To obtain the change in accuracy for any other power factor we have simply to multiply this radian measure by the corresponding tangent of the circuit phase angle. The series of graphs for various power factors is thus determined, so that the change in accuracy of the meter for any temperature change and any power factor can readily be inferred. Error in graph is fast.

increase in the resistances of the voltage circuit and of the plate or band used for lagging, due to temperature rise, causes a lead in the phase of the alternating flux due to the meter voltage. As the resistance changes are in practice small, we may legitimately assume that the angular change in the phase of the voltage flux, like

the change in the resistances, is proportional to the temperature change. The over-all effect of temperature variation thus may be taken numerically equal to the sum of the change in calibration and the product of the tangent of the circuit phase angle into the shift in the phase of the voltage flux expressed in radians (one radian equals 57.3 deg.).

This approximate procedure would of course be almost entirely unnecessary for temperature-compensated meters produced in the last three or four years.

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Refrigeration Sales Exceed Quota

By J. E. DAVIDSON
Chairman N.E.L.A. Electric Refrigeration Bureau

IN THE sixteen months of the Refrigeration Bureau's existence* 1,230,000 household electric refrigerators have been sold, representing more than a quarter of a billion dollars in sales to the electric refrigeration industry and nearly thirty millions of dollars of new annual revenue to central stations.

Conservative counting indicated that approximately 950,000, or 95 per cent, of the national quota were sold in 1931. It has been impossible to trace all sales, but I am convinced that actual sales exceeded the million mark, and this in a year which was a dismal one in most lines of business. The goal of the bureau is "Another Million in 1932." Sales for the first four months were 261,000, or more than a fourth of the year's quota.

The bureau has brought together into a business brotherhood the refrigeration interests in more than 8,000 communities, radiating from more than 400 major cities. It has brought together the refrigeration and central-station industries in the sympathetic understanding of mutual problems and their solution. It has pointed out also the way whereby central stations and all sellers of electrical merchandise may work together in harmony with profit to both. It has actually built up a new unwritten code of business ethics and fair dealing.

Mr. Dealer, being a good business man, could not help admitting that if all the refrigerator dealers in town could get together in a co-operative electric refrigeration show it would be a great business-getter. He could not help admitting that some joint newspaper advertising would do good and that if the cost were split up among a number of dealers it would scarcely be felt; that anything which stirred up the public about electric refrigeration was all to the good. In other words, he began to realize that his toughest competitor was not his rival refrigerator dealer, but all business competing for a share of the consumer's dollar.

Accomplishments in four cities

The St. Louis bureau has been active for a year. It has fostered co-operative exhibits, local advertising, prize contests. Its quota for refrigerator sales in 1931 was 5 per cent of its domestic lighting customers, or 11,500. This 5 per cent ratio was the nation-wide basis of quotas. Actually, 24,144 refrigerators were sold in St. Louis in 1931—more than twice the quota.

But even so, much more important are these additional facts. While the central station is in direct competition for refrigerator sales with the 160 refrigerator dealers and distributors who are members of the St. Louis bureau, these dealers and distributors sold 92.2 per cent of all the refrigerators and the central station was quite satified to sell but 7.8 per cent. Not only was the central station satisfied to sell this small percentage of the total but it gladly contributed three-fifths of all the funds of the St. Louis bureau. C. E. Michel, who directed the work of this bureau, considers that the added domestic load from more than 24,000 new refrigerators is pretty good business for his company. I am sure that he has no regret because his company sold less than 8 per cent of these new refrigerators. I am pretty sure, too, that the 160 dealer members of the bureau in St. Louis do not begrudge the central station its modest proportion in the big sales total. They are appreciative of the tremendous aid the central station has been in fostering the local bureau and in making possible a new record of sales for the whole St. Louis refrigeration business.

In this one example you have the complete answer as to why the Electric Refrigeration Bureau is a success—the proof that a central station can sell electric refrigerators and still be on excellent terms with local refrigerator dealers.

In Boston the electric refrigerator sales quota for 1931 was 15,000. However, 17,850 electric refrigerators were sold, of which the central station sold 11 per cent. In Philadelphia the quota was 25,500 refrigerators and actual sales were slightly over 30,000. The central station sold 9.2 per cent and contributed $25,000 toward the total of $40,000 expended by the Philadelphia Electric Refrigeration Bureau. In Kansas City the quota was 5,400 refrigerators and 9,485 were sold, of which the central station sold about 5 per cent.

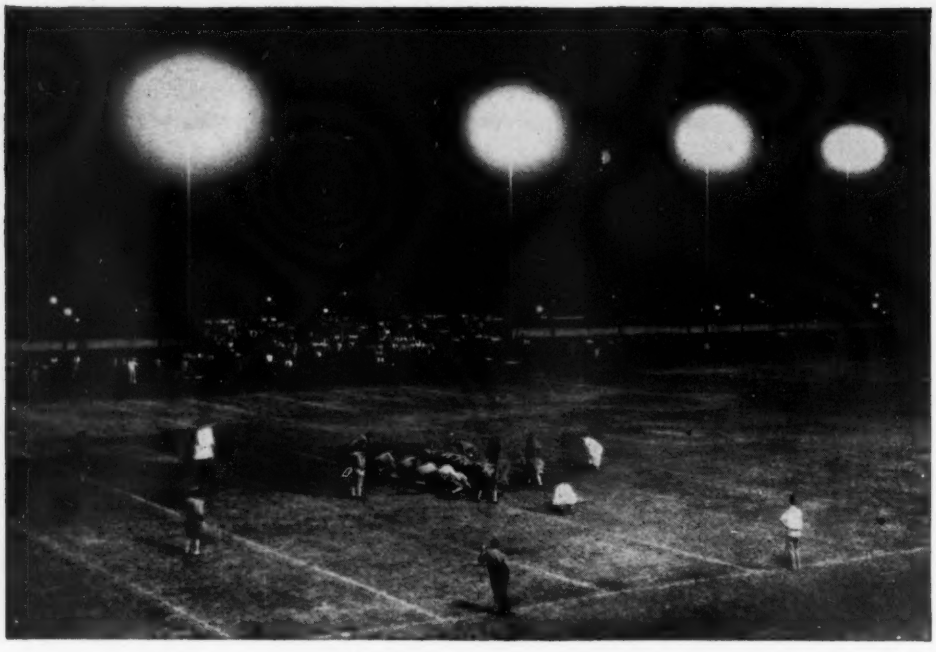
Points way to better trade relations

As to the future, the Electric Refrigeration Bureau will continue. More local bureaus will be established. Central stations and local sales outlets will work in even closer friendship and harmony. And as time goes on these local bureaus will demonstrate again and again the fact that the central station can sell electrical merchandise in so fair a manner and with such effective co-operation with other sales outlets that the most cordial and friendly relations result.

As a shining light in the darkness, the Electric Refrigeration Bureau illuminates the clear path for proper trade relations and increased sales in all lines of electrical merchandising for the central station, local dealers, distributors, jobbers and manufacturers.

From the electrical industry I expect to see the bureau idea spread to other lines of business. A new era will evolve from such co-operation, in which inevitably business will be better and cleaner.

**Active since March 1, 1931.*



Seven foot-candles proves adequate

By C. H. BRONNER

Lighting Service Department, Consolidated Gas, Electric Light & Power Company, Baltimore, Md.

Athletic Field Illumination Promotes Diversified Sports

NIGHT football admittedly lacks full conformity with many of the traditions of the game, but it is well not to lose sight of the fact that football is the main support of all other collegiate sports. When unfortunate circumstances result in a poor season for the former the latter are sure to suffer. The colleges that had the courage to violate tradition and install lighting for night football amazed the collegiate world with their increased attendance. Consequently the athletic association of Johns Hopkins University in 1930 decided to light the football field at Homewood. As a result many fond parents and other football enthusiasts who were unable to leave their business to attend afternoon games have since been able to enjoy the night games under conditions in some cases even more favorable than in the afternoon.

The problem of lighting this field was carefully studied by engineers from both the university and the local public utility from the standpoint of initial cost, cost of maintenance, permanence of the installation and the results to be obtained in field illumination. Previous installations were studied with the idea of profiting by their experience and adding what improvements were possible without exceeding the $10,000 budgeted allowance for the purpose. The performance of the resulting installation has justified this careful study.

The installation consists of 96 kw. in 32 twin-lamp, open-type projectors, sixteen on each side of the field. Each of these projectors contains two 1,500-watt lamps with each lamp wired through a separate fuse to opposite sides of a three-wire, 120-240-volt system. Two projectors are mounted on each of the four end poles and three on each of the remaining poles, with provisions for an additional projector on the end poles should this be desirable. The twelve poles supporting these projectors are 65 ft. long and were fabricated from five sizes of standard steel pipe beginning with 9-in. pipe at the bottom and diminishing in 1-in. steps to 5-in. pipe at the top. At each joint the larger pipe is shrunk to the smaller pipe and welded. The poles are set in the ground 8 ft. and concreted, and they project out of the ground 57 ft. They are spaced at intervals of 50, 60, 80, 60 and 50 ft. down each side of the field, starting from either goal line. In order to include the cinder track and leave the entire field unobstructed, the poles are placed outside of the fence inclosure, which is approximately 43 ft. from the side line, thus spacing the poles about 250 ft. apart across the field.

Three-wire service facilitates control

The wiring of the installation was simplified by treating each side of the field as a separate unit. The power company feeds the field from two points, placing the transformer poles in line with the steel poles and within 35 ft. of the last pole, thus reducing the length, and consequently the size, of the secondary wires to a minimum. Two wooden cabinets are built on each transformer pole about 3 ft. from the ground, one to house the power company's meters and equipment and the other to house the switches and main cut-outs. Each side of the No. 4/0 three-wire

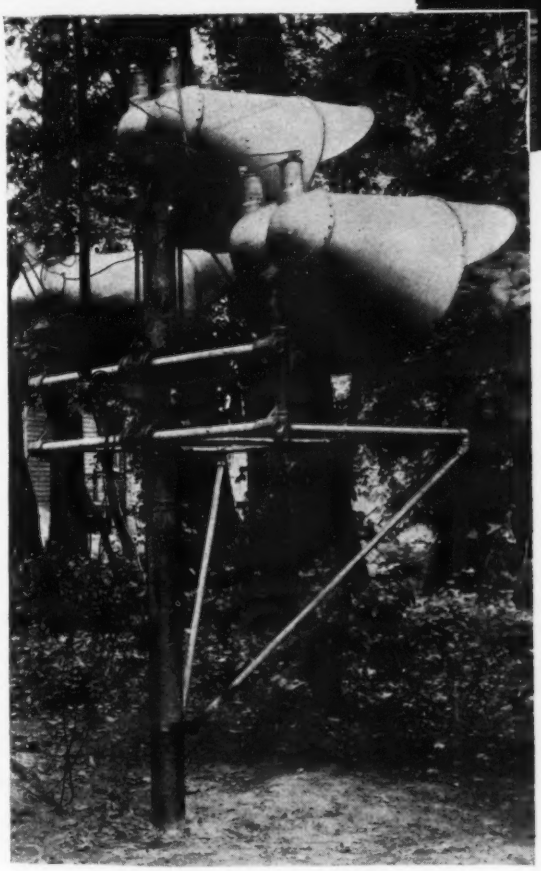
feeder is controlled separately and, as mentioned before, each lamp in the two-lamp projector is separately fused and wired on opposite sides of the line so that one lamp in each projector is lighted when one side of the line is thrown on. Thus the field may be lighted to one-half the intensity without materially disturbing the distribution of light.

The unique feature of this installation is the projector and platform support designed and constructed at the university, details of which may be seen in the accompanying illustration. The pole clamps, davit supports and fittings are cast iron, while the crossarms, davit and platform supports are made of galvanized pipe. The platform itself is simply a board laid across the pipe support and having cleats fastened to it to keep it from slipping out of place. This platform is disposed of when not in use by pushing it back against the pole or lowering it to the ground by means of the davit. The davit holds the projector at its balance point immediately over its support so that it may be fastened in place without difficulty. So far the burned-out lamps have been renewed and the projectors have been repainted from the platform without moving the projectors from the predetermined adjustment made before the system was ever turned on.

A day view of the field from the grand stand, showing construction details of the lighting installation

Close-up of experimental projector assembly

Twelve such supports are mounted on the poles. Framework is of cast-iron fittings and galvanized pipe. Two 1,500-watt lamps per unit.



Readjustment of the two projectors on each end pole was made only for lacrosse and polo.

Soccer, polo and lacrosse as well as football

The university has not solicited outside teams to use the field for night games, yet before the field was finished one of the local schools had chartered the field, and out of eight football games played in the fall of 1930 five were by outside contestants who rented the field. The three games played by the university team resulted in twice the amount of gate receipts that would have been expected in the daytime. Since this time the field has been used for night soccer, the visiting team being the Glasgow Celtics of Scotland, a championship lacrosse game at night between Canada and the United States, a South Atlantic championship track meet at night and seven games of night polo between various teams. While the intensity is only 7 foot-candles, there has been nothing but the most favorable comment from players, spectators and newspaper critics in the matter of an adequate amount of illumination sufficiently free from annoying glare.

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Clamp Tightens Meter Test Connections

On meter test boards fitted with groups of spring-supported fingers which fit into the meter terminal blocks and which make the operation of connecting a meter for test merely a matter of setting it in place there is some possibility of poor connection at one or another terminal due to differences of spring strengths on the finger connectors. This danger, remote as it may appear to some meter men, is removed from the range of possibility in the testing room practice of the Toledo Edison Company. Just above the hanger stud of each meter position on the test board is a flat fiber eccentric cam. Half-circle rotation of the cam forces the meter down against the springs of the connector fingers and holds it tightly against them, thus assuring perfect contact in each terminal.

Rural Substation Developed to M

By GEORGE H. LANDIS
Assistant General Superintendent of Power
Central Hudson Gas & Electric Corporation

Fig. 1—Metal-clad rural substation opened to show features

On the extreme left is an oil-filled compartment in which the supply cable terminates. The tap-changing mechanism for voltage regulation is normally immersed in oil and is operated by motor below. Note steel barrier between hinged switchboard and line parts.

THE rapid growth of line extensions and loads in rural areas has necessitated the installation of small automatic substations at approximate load centers throughout such areas. The length of feeders radiating from such substations has required careful investigation into regulation and detailed study as to probable growth in the area served to determine the best location of such a substation to meet the future demands. Such a station must often be located near rural communities where good appearance is a factor. Being unattended, barriers erected to prevent unauthorized entry may sometimes be ineffective, and accidents to trespassers have been known to occur.

A rural territory such as described is represented by Fig. 2, which shows one of several areas served by the Central Hudson Gas & Electric Corporation. Normally the distribution feeders from each substation operate as radial feeders, but they are gradually being extended, as additional customers are connected, and are becoming station tie lines. Ultimately, as load conditions warrant and these tie feeders are completed, this will allow any station to be taken out of service for maintenance without causing interruptions of service. Due to the length of feeders it is evident that the removal of a station from service should be made only during light-load periods, although in emergencies service may be maintained with voltage variations somewhat greater than normally allowable. For those infrequent occasions requiring that a substation be removed during peak-load conditions, this class of service cannot warrant the investment necessary for voltage regulation afforded in urban areas.

To provide a substation design that would suit the class of service described a study was undertaken. The requirements which had to be met were:

1. The installed cost must be low.
2. With change in load center, it must be possible to move the substation easily and economically.
3. The substation must provide voltage regulation to compensate for both transmission-line and primary-line drop.
4. It must be easily and safely maintained.
5. It must be inconspicuous, of pleasing appearance and present a minimum public liability hazard.
6. Ready removal and replacement of any piece of apparatus, particularly the transformer, must be possible in case of breakdown.
7. Opportunity to add feeder circuit breakers readily and economically as load conditions demand must be afforded.

In collaboration with the General Electric Company a design was prepared and a unit built which meets all the requirements. The development of the medium-voltage network unit with a regulating transformer afforded a basis for the design. Simplification of the breaker and control layout, using low-duty oil circuit breakers, allowed the construction of an inexpensive unit, comparable in cost with a small rural substation of ordinary exposed-type construction.

The complete substation installed at Washington Hollow is shown in Fig. 1, with doors and compartments opened to show the details of construction. This installation, consisting of a 750-kva. transformer and one feeder circuit breaker, occupies a ground area of only 10x13 ft. Each additional feeder will add 5 ft. to the latter dimension.

The power supply to the transformer is brought through a three-conductor, type H, 25,000-volt underground lead-covered cable from an overhead transmission line approximately 500 ft. away. This cable terminates in a disconnecting pothead bolted to an oil-filled compartment mounted on the transformer case. By disconnecting the terminals in the compartment the pothead can be removed from the housing without disconnecting the cable. This permits easy removal of the transformer in case of failure.

Housed in the oil-filled compartment (Fig. 3) is a three-pole, gang-operated disconnect switch, which is adequate to break the magnetizing current, but not the load currents. This switch is electrically interlocked to prevent its operation except when all feeder breakers are open. Above the disconnect switch compartment are

o Meet Seven Requirements

mounted three S & C fuses in an insulated and barriered housing. A hinged door allowing access to the fuses is mechanically interlocked with the disconnect switch, requiring this switch to be in the open position before the door can be opened. A wire-glass window allows inspection of fuses without opening the fuse compartment.

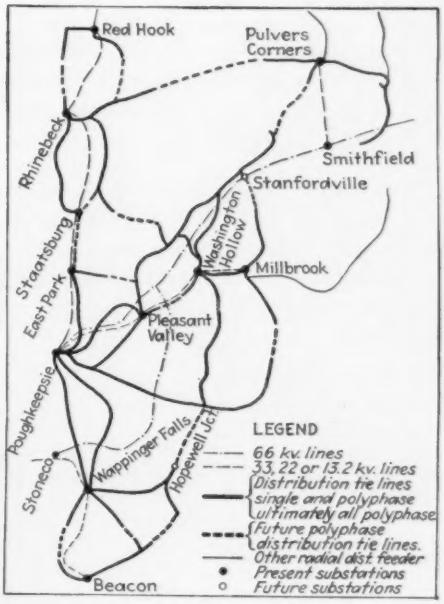

Fig. 2— Typical rural area to which metal-clad substation is being applied

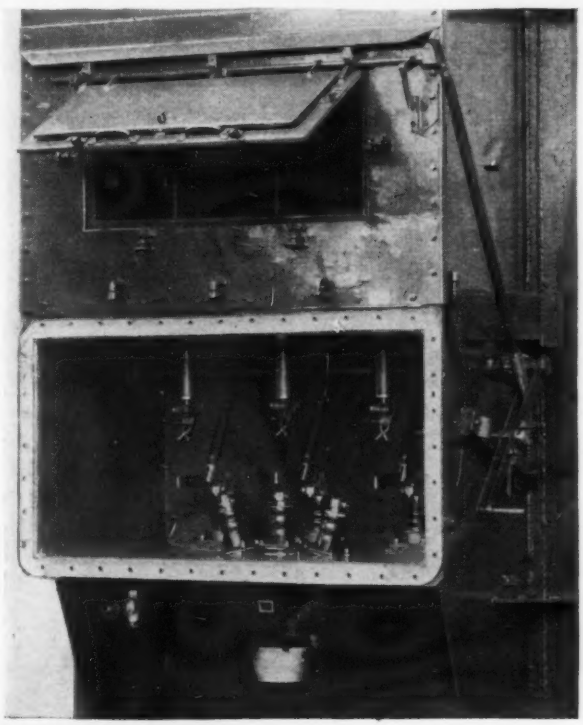

Fig. 3— Oil-filled compartment in which supply cable terminates

Note gang-operated disconnects operable from exterior are mechanically interlocked with door over fuse compartment. The disconnects are also electrically interlocked to prevent operation except when feeder breakers are open.

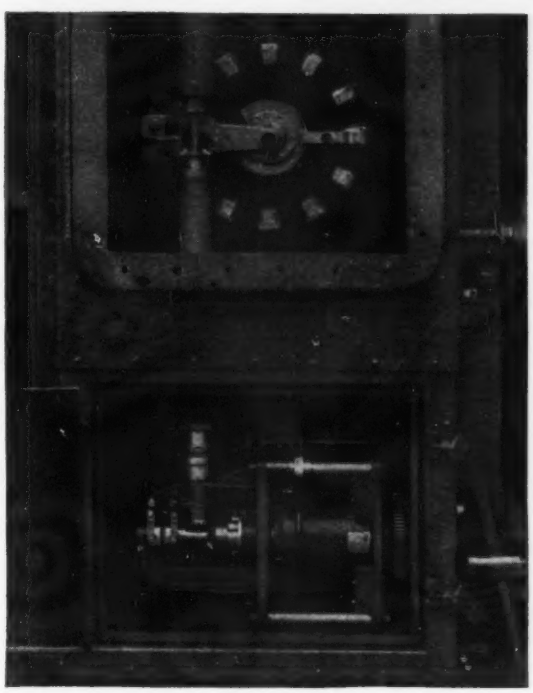

Fig. 4— Combined motor and spring-operated device actuates tap-changing mechanism

Bushings through the transformer case form the load-side support of the fuses.

The transformer is a 750-kva., self-cooled, three-phase, 60-cycle, 13,200/22,900(Y) — 2,300/4,000Y/-4,600/8,000 (Y)-volt unit with a 110-volt tertiary for Y-Y operation. A nine-position load-ratio control (Fig. 4) in the high-voltage winding provides 10 per cent voltage regulation under load in steps of 1.25 per cent. This is operated through a combination motor and spring-operated device, which changes tap positions in a small fraction of a second, without interrupting the circuit, the tap winding being bridged by a reactor during the tap-changing period. The motor driving this mechanism is actuated by a contact-making voltmeter with a current-compensating device, allowing bus voltage compensation for average line drop to load center.

The low-voltage terminals, brought out through the side of the transformer case, are inclosed in a steel housing which bolts directly to a standard outdoor type steel switch house. This contains the first reclosing feeder breaker with induction overload relays, reclosing timer, station transformer, metering equipment and the contact-making voltmeter. Additional feeders may be attached to the unit by bolting additional switch houses to the existing house, forming a continuous inclosed bus.

Field construction for the installation of this complete unit is a minimum, as it is only necessary to install a light foundation, with underground cable leads. The entire unit is completely wired and equipped in the factory, the only erection work consisting of bolting the transformer to the switch house and connecting the cables.

The unit requires a minimum of maintenance, since all parts are inclosed in steel, and all parts requiring routine inspection or test are readily accessible. From a safety viewpoint the unit is ideal since there are no exposed

live parts, and the usual practice of employing a high barbed-wire fence may be substituted with a more attractive and less expensive fence or hedge.

Since little of the expenditure in this type substation is tied up in non-movable equipment, the substation can be readily moved if load or other conditions warrant such a change.

The limited operating experience covering a period of three months fully meets the expectations. An average of 60 tap changes daily during the winter peak have indicated the possibility of maintaining voltage regulation as satisfactorily as with the conventional voltage regulator.

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Are Street-Lighting Rates Comparable?

Data on tne cost to the government of the District of Columbia of operating street lights have been submitted by Walter E. Kern, electrical engineer for the district, who calls attention to the difficulty of obtaining similar data from other cities and suggests a compilation of such information. Referring to the District of Columbia street lighting he says:

"Underground cables from the transformer manholes are usually run in a trench in the sidewalk back of the curb. Existing conduits are used if advantageous. Conduits are installed across streets, alleys and driveways.

"When the municipality furnishes the luminaire type of post it is complete with base, shaft and luminaire, less socket, receptacle and lamp. The municipal-owned post for alley lighting is furnished complete with radial wave reflector, less socket, receptacle and lamp. The utility company erects all posts and furnishes, installs and maintains all wires, cables, transformers, switches, incandescent lamps, etc. The first luminaire globe is furnished by the municipality, all replacements thereafter are made by the utility company. In case of breakage of municipal-owned post the municipality furnishes a new one, the utility company furnishing the necessary labor and other materials for re-erection without additional cost to the municipality."

The question arises, however, whether street-lighting rates are comparable unless more conditions are stated and what important factors should be included to make the data have any significance.

Street-Lighting Rates in Washington, D. C.

Type of Lamp	Number	Rate per Annum
6.6 amp. arc. UG. DC	1,092	$80.91
6.6 amp. arc. UG. DC., twin	376	72.82
Incandescent		
1,000-CP. UG. DC	646	71.00
1,000-CP. UG. DC., twin	34	63.90
600-CP. UG. CO	48	55.45
600-CP. UG. DC	1,898	53.80
600-CP. UG. DC., twin	314	48.42
600-CP. SP. CO	9	50.22
400-CP. UG. CO	58	47.21
400-CP. UG. DC	2,603	45.56
400-CP. UG. DC., twin	8	41.00
400-CP. UG. CO., twin	558	41.83
400-CP. OH. CO	0	35.64
250-CP. UG. CO	15[1]	30.78
250-CP. UG. CO	129	30.23
250 CP. UG. CO., twin	518	26.545
250-CP. UG. DC	7,919	28.58
250-CP. OH. CO	2,862	22.80
250-CP. OH. CO., twin	596	19.86
250-CP. OH. CO	37[3]	20.40
250-CP. UG. CO., multiple	4	30.23
250-CP. UG. DC. multiple twin	60	25.72
100-CP. UG. CO	37	19.08
100-CP. UG. DC	856	17.43
100-CP. UG. DC., twin	2	15.685
100-CP. OH. CO	59	13.20
96-CP. UG. DC., multiple	17	17.43
60-CP. UG. CO	30	16.19
60-CP. UG. DC	51	14.54
60-CP. OH. CO	4,326	11.70
56-CP. UG. CO., multiple	50	16.19
56-CP. UG. CO., multiple twin	12	13.91
56-CP. UG. DC., multiple	8	14.54
56-CP. OH. CO	28	11.70
Fire alarm designation, 8 cp	657[2]	7.50

Energy cost, 2 cents per kw.-hr. Twin rates are 90 per cent of single rates. U.G. denotes underground cables. O.H. denotes overhead wires. CO. denotes post owned by utilities company. D.C. denotes post owned by municipality. [1] Special design post. [2] Bare lamp. [3] A 23-watt lamp is actually used.

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Speed in Rubber Glove Testing

Two new wrinkles in rubber glove testing by the Toledo Edison Company permit a large number of gloves to be checked with a comparatively small equipment installation. One is a motor-rotated bus in the test circuit by which the leakage current in each glove is read while the test is in progress. Six gloves are in the test bath at one time. They are in parallel under 10,000 volts for three minutes. When the operator's stop watch indicates two minutes has passed he starts the rotating bus motor and the milliammeter is cut into series with each glove in succession. The operator notes the leakage currents as they appear on the meter. At the end of the cycle of meter indications the rotating bus motor is automatically cut out.

The other time saver is a glove drier. The gloves are placed on wire frames over the ends of the vertical risers from the trunk air pipe and air is blown into them. The blower is one that was salvaged from a vacuum cleaner. Compared with merely hanging the gloves on a line, like Monday's washing, the blower dries out the gloves in less than a tenth of the time.

April Revenue 6.4 per Cent Under 1931

DURING April the operations of electric light and power companies continued lower than in the corresponding period of 1931, as had been the case for a number of months. Moreover, the spread from the preceding year was widening. As is apparent from very recent weekly reports of energy output the tide has apparently turned, but that change occurred much too late to be reflected in the general operating data for April, which have now become available.

Energy output during the month was 12 per cent smaller than it was a year ago. This is the greatest decline for any month thus far reported. Similarly the decrease of 6.4 per cent in revenue—from $176,210,000 to $164,860,000—is a new record. Other recent percentages were: December, 3.7; January, 4.5; February (one day longer than in 1931), 3.9; March, 4.3.

Operating and maintenance expenses fell from $75,880,000 a year ago to $70,756,000, almost in the same ratio as revenue. The amount shows little change from the two preceding months.

Of the total energy output water power contributed 46 per cent, an unusually large fraction. The amount from this source was almost identical with last year's April. Fuel output, in contrast, has for each of the past four months fallen short of last year's, in the corresponding periods, by about 20 per cent. This indicates a reduction of fully 600,000 tons of coal, or its equivalent, per month and so accounts for a considerable part of the diminution of operating expenses. Thus the cut in wages and other items falls far short of the $5,000,000 difference in operating expenses compared with 1931.

Every geographical region reported a greater decrease in revenue compared with 1931 than in March. The smallest, 3.3 per cent, was in New England; the largest, 8.9 per cent, in the East North Central States. Regions west of the Appalachian Mountains all had a greater decrease than those along the Atlantic Seaboard.

On the basis of the present statistics on output, it is scarcely to be expected that the revenue figures for May will reveal any improvement over April. The same may be said of June; for July the indications are that revenue will approach that in 1931 a little more closely.

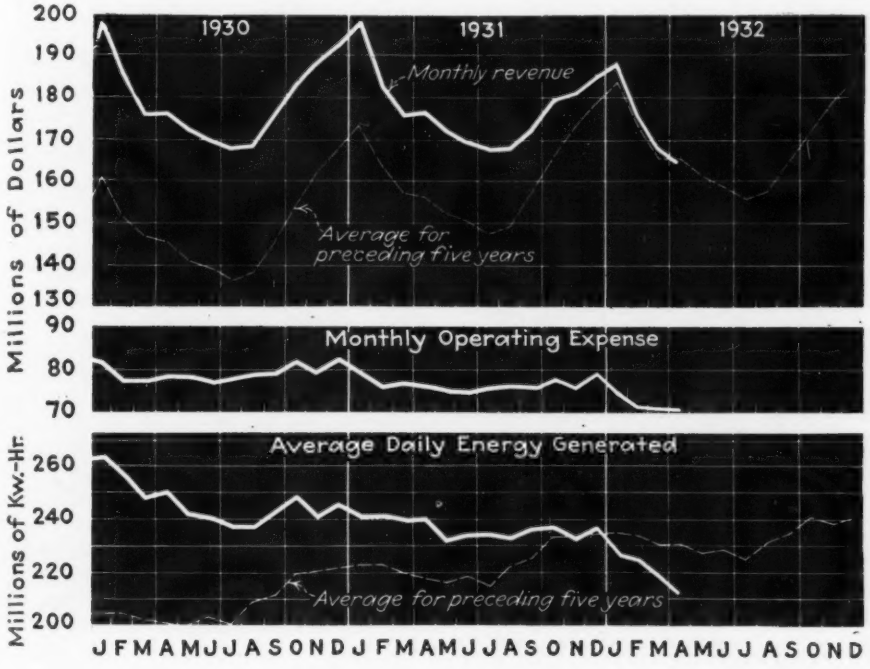

Table I—Energy Output of Central Stations in the United States

Compared with Corresponding Month of Previous Year

Month 1932	Generated, Thousands of Kw.-Hr.*						Purchased for Resale	
	Total		Hydro		Fuel			
	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Thous. Kw.-Hr.	Per Cent Inc.
January	7,082,464	— 5.4	2,929,308	+31.9	4,153,156	—21.1	1,985,000	+ 1.0
February	6,533,343	— 3.3	2,795,460	+36.1	3,737,883	—20.7	1,874,000	+ 3.0
March	6,805,693	— 8.4	2,908,794	+16.5	3,896,899	—21.1	1,884,000	+ 6.9
April	6,341,207	—12.0	2,946,995	— 0.2	3,394,212	—20.0	1,650,000	— 9.0

Table II—Regional Operation, Revenue, Energy Output, in April, 1932

Compared with Corresponding Month of Previous Year

Region	Revenue		Energy Generated, Thousands of Kw.-Hr.*					
			Total		Hydro		Fuel	
	Thousands of Dollars	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.
United States	164,860	—6.4	6,341,207	—12.0	2,946,995	— 0.2	3,394,212	—20.0
New England	17,110	—3.3	435,654	— 9.8	296,953	— 3.2	138,701	—21.1
Middle Atlantic	44,640	—4.6	1,558,346	— 9.1	512,979	— 6.0	1,045,367	—10.3
East North Central	38,910	—8.9	1,464,521	—14.5	225,766	+29.0	1,238,755	—19.3
West North Central	13,710	—7.0	408,257	— 9.1	146,167	+23.2	262,090	—20.7
South Atlantic	18,780	—4.3	815,849	—10.7	548,391	— 5.2	267,458	—19.8
East South Central	5,410	—7.6	274,415	—13.0	233,848	—10.5	40,567	—27.2
West South Central	7,960	—8.7	309,008	—10.3	18,877	+106.0	290,131	—13.7
Mountain	3,750	—8.8	190,305	—25.0	148,601	—26.7	41,704	—17.2
Pacific	14,590	—8.1	884,852	—12.5	815,413	+ 8.1	69,439	—73.2

*By courtesy of U. S. Geological Survey, with deductions for operations not regarded as central-station operations.

Table III—Central-Station Financial Operations in the United States

Compared with Corresponding Month of Previous Year

Month	Total Gross Revenue from Sale of Energy*		Total Operating and Maintenance Expense†	
	1932 Thousands	Per Cent Inc.	1932 Thousands	Per Cent Inc.
Jan.	188,010	—4.5	73,940	—6.3
Feb.	175,110	—3.9	71,190	—6.1
March	168,280	—4.3	70,690	—7.6
April	164,860	—6.4	70,756	—6.7

*Aggregate gross revenue from consumers and from other utilities for energy for resale, involving a certain amount of duplication.

†Do not include interest, taxes, depreciation or sinking fund, with some unavoidable exceptions.

Men of the Industry

J. D. Donovan Heads Iron and Steel Engineers

J. D. Donovan, superintendent of the electrical and mechanical departments of the Republic Steel Corporation with offices at Canton and Massillon, Ohio, was elected president of the Association of Iron and Steel Electrical Engineers,

which met last week in Pittsburgh. Mr. Donovan has been associated with iron and steel plants for the past 26 years and his experience was obtained with the Carnegie Steel Company, New York Steel Company, Midland Steel Company, later with the Illinois Steel Company at Gary, Ind., then with the Lackawanna Steel Company at Lackawanna, N. Y.

Mr. Donovan's election to the presidency of this engineering society follows many years of service on national steel mill committees, at which time many specifications and codes were prepared which have proved of immeasurable benefit to the steel mills of the world. He has been instrumental in assisting in the preparation of the specifications and codes covering electric overhead traveling cranes, standard mill type motors, rules for the safe operation of cranes and large mill type motors for driving rolling mills.

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T. W. Martin Resigns From Commonwealth & Southern

Thomas W. Martin, president of the Commonwealth & Southern Corporation since 1929, has resigned from that position and will be succeeded by B. C. Cobb, chairman of the board, who will occupy both offices. Before the corporation was organized to merge the Penn Ohio Edison, Commonwealth Power and Southeastern Power & Light companies Mr. Martin was head of the last named. He is president of the Alabama Power Company, a subsidiary of Commonwealth & Southern, at the present time, and he will give all his time to the duties of this office. Mr. Martin will continue as a director of Commonwealth & Southern.

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ALFRED D. FLINN, director of the Engineering Foundation, New York, was made the recipient of the honorary degree of doctor of engineering by the Worcester Polytechnic Institute.

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JOHN B. WHITEHEAD, dean of the School of Engineering, Johns Hopkins University, was awarded the Cresson medal by the Franklin Institute of Philadelphia at the medal day exercises held May 18. The award was made to Dr. Whitehead in consideration of his many original investigations of dielectric behavior and allied subjects.

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F. D. Weber New President of Electrical Inspectors

Fred D. Weber, who was elected president of the International Association of Electrical Inspectors, as announced in the May 21 issue of the ELECTRICAL WORLD, has been particularly active in the inspection branch of the electrical industry, having helped organize the Northwest Association of Electrical Inspectors in 1926 and having served as its secretary-treasurer since that time. At the present time he is connected with the Oregon Insurance Rating Bureau, Portland, in the capacity of electrical engineer.

A Californian by birth and a gradu-

ate of the University of California, Mr. Weber, after a period of sales and engineering work with the Westinghouse Electric & Manufacturing Company and the Allis-Chalmers Manufacturing Company, joined the Board of Fire Underwriters of the Pacific at Portland in 1909 and has been associated with this organization and its successors since. He is a member of the American Institute of Electrical Engineers, the Northwest Electric Light & Power Association, the Electrical Council of the Underwriters' Laboratories, Inc., and of the electrical committee of the National Fire Protection Association.

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THOMAS CHANDLER, president of the Edison Sault Electric Company, Sault Ste. Marie, Mich., has been made president also of its newly acquired subsidiary, the Manistique (Mich.) Light & Power Company. GEORGE W. BALDWIN, vice-president of the Edison Sault Electric, will serve also as executive vice-president of the Manistique property.

▼

OBITUARY

PROF. GALTANO GANASSINI, one of the leading authorities on hydro-electric installations in Italy, died recently in Milan in his fifty-eighth year. Professor Ganassini had done much to develop the water power resources of the country.

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G. HERBERT WHITTINGHAM, chairman of the board of the Monitor Controller Company of Baltimore, Md., died June 4 in that city, after a brief illness. He was 65 years of age. Mr. Whittingham entered the electrical business in 1888 and was one of the early leaders in electrical development.

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RICHMOND TALBOT, a member of Sanderson & Porter, engineers, died May 26, at his home in Tuxedo Park, New York. Mr. Talbot was a native of New York City and a graduate of Harvard University. He was a member of the American Institute of Electrical Engineers.

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JOHN H. BICKFORD, an engineer and architect associated with the design of a number of electric lighting and railway plants in various parts of the East, died at his home in Salem, Mass., May 19. He was born 72 years ago at Alton, N. H., and in earlier years was engaged in telephone work.

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DR. F. W. MEYER, professor of engineering at the Carolo Wilhelmina Technical High School at Brunswick, Germany, died recently, at the age of 55. From 1911 to 1913 he was on the staff of the Westinghouse company at East Pittsburgh and later was engaged in research work at the Phoenix Physical Research Institute of Columbia University, New York. Professor Meyer was a leading German authority on electronics.

New Equipment Available

Substitute for Rubber Has Many Advantages

A new chemical product which has practically all the characteristics of rubber, but which is not affected by solvents as rubber is, has been announced by the Thiokol Corporation, Yardville, N. J. A number of leading electrical manufacturers are testing "Thiokol" for use in the following applications: Protective covering for underground low-voltage cable, connections for oil-filled cables for transmission use, submarine cables, ignition cables to protect against oils and corona conditions, for protecting drop-cords against oil in machine shops, wiring for plants having corrosive fumes such as those in powder and dye factories, transformer gaskets, high-voltage cable covering in place of lead for protection against soil and corona conditions.

When in contact with oils, "Thiokol's" physical properties as regards tensile strength, abrasion, etc., are much better than even the best rubber stocks, it is claimed. Whereas rubber loses as much as 90 per cent of its tensile strength when immersed in gasoline, "Thiokol" compound retains all its qualities. Unlike rubber, it does not age in storage. Oxygen does not appear to affect it. Even the ozone generated during electrical corona tests does not cause degradation, although rubber breaks down in a short time.

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Improved A.C. Relays Offer Pressure Contact

New forms of alternating-current relays developed for accurate, chatterless performance and known as type X20 are announced by the Leach Relay Company, San Francisco, Calif. Operating on a different principle than the customary types, the design uses a stationary armature and moving field and advantage is taken of the inertia of the coil and core to assist in overcoming chatter. This plan of construction and operation is said to develop a greater consistent pull and heavier contact pressure with a given input than in other types using the light-moving armature construction.

Some of the advantages of these relays are: A fully laminated armature and core for the reduction of heating and general all-around efficiency increase; the armature is cast into the molded bakelite base, which holds it secure and rigid; the surface is then faced off properly to receive the poles of the moving core; the combination of a rigid armature and a comparatively heavy moving element further assists in overcoming flutter, chatter and hum; the shading ring does the rest.

The type X20 relays may be had for either a.c. or d.c. operation, the a.c. from 6 volts to 115 volts and the d.c. from 2 to 24 volts.

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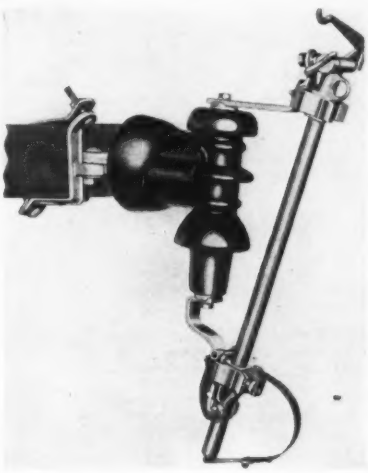
Arcless Disconnect Cartridge

The new Matthews arcless disconnecting cartridge, recently introduced by the W. N. Matthews Corporation, St. Louis, Mo., combines in a single unit a manu-



ally operated disconnecting cartridge and automatic fuse protection wherein the arc accompanying disconnection is confined within the fiber fuse cartridge. This new cartridge has a special top terminal on a bakelite covered horn fiber tubing, which permits instant disconnecting by merely pulling or bumping the lever with a switch stick. The lower terminal is equipped with a Matthews "Pullink" that instantly draws the link from the cartridge and throws it to the ground when the lever is pulled or the fuse blows. The disconnecting cartridge is an added protection for the lineman. These cartridges can be supplied to fit any series 1400 to 1407 and series 1300 to 1315 open-type Matthews "Fuswitches."

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SLIDING-CONTACT TUBULAR RHEOSTATS known as "Jagabi," used largely for laboratory and scientific use, are announced by the James G. Biddle Company, Philadelphia, Pa. Some of the new features are: A molded bakelite sliding saddle carries the sliding-contact brushes, which adds greatly to convenience, appearance, insulation and ruggedness; they have one-piece supporting brackets made of pressed steel, with no rivets or welds; the terminals are mounted firmly and rigidly on the supporting brackets instead of on the end bands, which tended to loosen with normal use, etc.

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Thermoplastic Material Is Versatile Insulator

An improved laminated fibrous base material known as "Vulcoid" has been developed and perfected by the Continental-Diamond Fibre Company, Newark, Del. It differs from other insulating materials in that it is said to combine in a low-cost insulating material the desirable properties of all existing laminated fibrous insulating materials. The outstanding property of vulcanized fiber is its toughness. It will stand an amazing amount of physical shock without cracking, splitting, splintering, shattering, or in any way showing ill effects, it is claimed.

"Vulcoid" is made in standard sheets, rods and tubes. It may be machined, punched or formed in any way. It is thermoplastic and may be permanently formed to any shape by heating. Its insulating and moisture-resisting properties are unaffected by machining as it is chemically processed throughout.

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Test Cabinets Control Atmospheric Conditions

A new type of cabinet to provide facilities for control and constant maintenance of vapor pressures, humidity and temperatures, at any values required within a wide operating range, permitting processing and observations of effects to be made under controlled atmospheric conditions, is announced by the Freas Thermo-Electric Company, Irvington, N. J.

It is applicable for experimental and routine work wherein it is desired to maintain a controlled condition of heat and humidity; in drying, baking and evaporating operations to control the rate of evaporation; for biological investigations where an environmental control is required to study the growth and development of various organisms, and in accelerated life tests.

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A NEW LINE OF METAL CABINETS for use in meter, transformer and relay testing departments for housing repair parts and tools are announced by the States Company, Hartford, Conn. They have patented swing drawers and are made from steel, strongly built and finished in handsome olive green enamel baked on to insure a durable finish.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body formed of 26 national electrotechnical committees). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

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NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION (Northwest Geographic Division N.E.L.A.). Secretary, Berkeley Snow, 1206 Spalding Building, Portland, Ore.

OKLAHOMA UTILITIES ASSOCIATION. Manager, E. F. McKay, 1020 Petroleum Building, Oklahoma City, Okla.

PACIFIC COAST ELECTRICAL ASSOCIATION (Geographic Division N.E.L.A.). Managing Director, K. I. Dazey, Room 630, 447 Sutter St., San Francisco, Calif.

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PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, A. Bliss McCrum, P.O. Box 1483, Charleston, W. Va.

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SOUTHWESTERN GEOGRAPHIC DIVISION, N.E.L.A. Secretary, S. J. Ballinger, San Antonio Public Service Company, San Antonio, Tex.

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WESTERN SOCIETY OF ENGINEERS. Director and secretary, E. S. Nethercut, 205 West Wacker Drive, Chicago, Ill.

WISCONSIN ASSOCIATION OF ELECTRICAL CONTRACTOR-DEALERS. Secretary, E. H. Herzberg, 1602 W. Wells St., Milwaukee, Wis.

WISCONSIN UTILITIES ASSOCIATION. Executive secretary, John N. Cadby, 135 W. Wells St., Milwaukee, Wis.